SCIENTIFIC AMERICAN

THE LOFTY CROW'S NEST OF AN OCEAN LINER

The Fifth Award of the Scientific American Medal

A Fort That Moves on a Railway Track

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SIXTEENTH ANNUAL
Motor Number
of the
SCIENTIFIC AMERICAN

January 3, 1914

THE oldest automobile paper in the world is the Scientific American. It has followed the development of the motor-driven vehicle from the very day of its birth, aiding and encouraging the "horseless carriage" in its early struggle for existence.

Every important phase of its progress has been chronicled in these columns.

For the past sixteen years we have published an annual *resume* of its growth in a special magazine number. Our first automobile number antedates the New York Annual Automobile Show by two years.

Everything new that is important will be taken up in our coming Motor Number. Among the subjects are the following:

The Automobile of 1914. There are fashions in automobiles as well as in dress. Although the American automobile is pretty well standardized, nevertheless there will be important differences in the car of 1914, which every motorist should know. Just what the changes are will be fully explained and illustrated.

New Ideas in Car Bodies. While we in this country have fixed upon a standard form of car body, abroad, particularly in France, new designs are being developed which are most interesting. Some of the new car bodies look exactly like a boat. Fifteen car-body designs will be illustrated and described.

The newest and most ingenious accessories will take up a page of the Motor Number. Of the making of accessories for automobiles there seems to be no end, yet, no doubt, many of them will prove indispensable to the motorist of 1914.

Lubrication is a subject that is far more important than the majority of automobilists realize. An excellent article on this subject is being prepared by an authority on oils.

Lessening fuel cost is perhaps the foremost topic of the year. Experiments are being made with new fuels and with apparatus that will permit the use of substitutes for gasoline. Our Paris correspondent will tell what is being done in this connection abroad.

Making the automobile comfortable in winter. Although the automobile was made an all-the-year-round machine long ago, it must be admitted that motoring is not half so pleasant in winter as in the warmer seasons. However, many improvements have been developed recently to overcome the rigors of frigid weather.

What car can I buy for $500, $1000, $1500, etc.? A feature of the Motor Number of 1913 was a table which classified American-made cars according to price. A similar table, but even more complete, is being prepared for 1914.

The commercial motor vehicle will receive due attention in the Motor Number. Important problems that present themselves to the owner of a commercial vehicle and to the intending purchaser of a motor truck will be treated by authorities on the subject.

Motor truck guide. Like the table on pleasure vehicles there will be a classified list of commercial vehicles arranged according to capacity which should prove indispensable as a guide to intending purchasers of motor trucks.

A Colored Cover by William Hernden Foster

Price, 15 Cents **On All Newsstands**

SIXTY-NINTH YEAR

SCIENTIFIC AMERICAN

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The Fifth Award of the Scientific American Medal

AT the time when the first award of the SCIENTIFIC AMERICAN medal was made, various devices were submitted to the committee, and all the members seemed to think that the sea offered the most dangers. The successful launching of lifeboats and the discovery of fire seemed to be the most interesting subjects presented. The terrible menace of conflagration won the victory and the medal was given to a very meritorious fire detecting device. The plurality of pipes leading to the various holds and bunkers with an electric operated fan to bring up the first wreaths of smoke to the bridge has proved its worth and certified to the judgment of the experts, but the lifeboat and its accessories still remained presumably safe. There was no danger, the wireless would bring all the ships in the lanes to attention when the "S-O-S" signal was flashed and all would be saved. Hulls were subdivided and bulkhead doors were closed from the bridge. The sea was robbed of its terrors.

Newspapers seemed to think that any exploitation of the lifeboat meant some free advertisement of some freak invention. All went well until there occurred one of the most cruel and unnecessary accidents in the history of the world. A proud ship on her maiden trip was wounded and sunk in a short time, entailing a loss of almost incalculable proportion.

Now at this late date we have all reversed ourselves, and the medal so much esteemed on account of the care used in its award goes to the company that for years has been harping on the fact that an adequate number of lifeboats, successfully launched would save passengers and crew until the arrival of succor summoned by wireless.

The American Museum of Safety as custodian from year to year of the SCIENTIFIC AMERICAN and other medals given for various achievements, has seen fit through its committee to award it for the fifth time in seven years to the Welin Marine Equipment Company of Long Island City, N. Y., for "efficient and dependable" devices for saving life at sea. The award contemplates not only a beautiful mechanical achievement in the way of a quadrant davit to which the survivors of the "Titanic" disaster owe their lives in many cases, but also a practically unsinkable lifeboat, a non-toppling block which does not fail after the boat has reached the water and an indestructible rope withstanding the atmospheric conditions for years. It is the Welin davit and the Lundin decked lifeboat that make up the principal elements of the award. Of course sufficient lifeboats must be provided for all, even if perfect mechanism for lowering and casting off and keeping afloat have been provided. Herein was the fallacy of the British Board of Trade rules. The "Titanic" complied with all the requirements, but look at the result. Now we have lifeboats nested in pairs, athwartships in three or more, stowed on the upper promenade deck

The Scientific American Medal, awarded for the fifth time.

as well as on the boat deck. This is all a step in the right direction.

The Welin davit permits of one or two rows of lifeboats either nested or in tandem being launched from

Swinging out the upper of two nested Lundin boats.

either side even with a severe list to port or starboard.

According to this invention the davit turns about a center moving along guides, and its lower end is in the form of a toothed quadrant, preferably circular, rolling on a rack. The weight of the boat and its contents tend to make the quadrants roll on the racks, inclining the davits more and more and at the same time moving them outward. The weight of the boat and its live load tend to assist in swinging the boat out over the water. Two sailors can launch a boat containing 60 persons with ease. The safety non-toppling block prevents the fouling of tackle especially when being raised with no load attached to lower the companion boat.

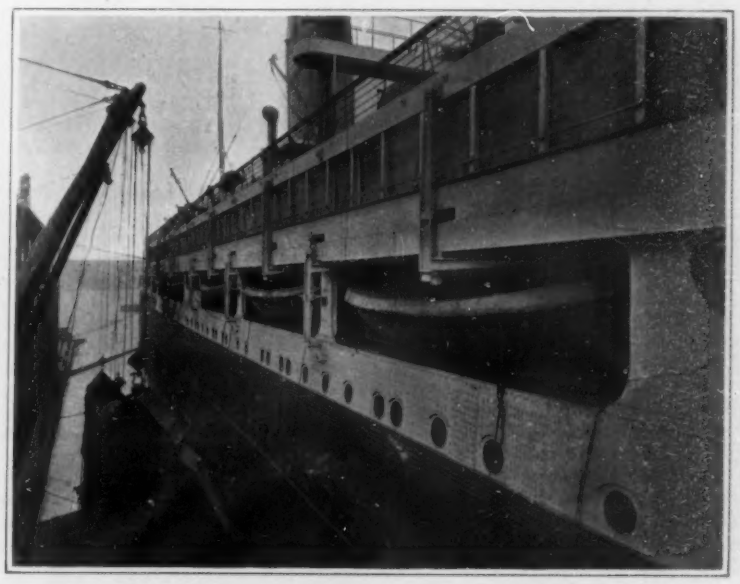
The Lundin lifeboat was a happy thought which was evolved after the "Titanic" disaster. The lifeboat which we illustrate is as "unsinkable" as a lifeboat can be made. It is built of steel with cellular bottoms and cannot be smashed, even if a heavy sea crushed it against a hull. The freeboard is high, and detachable fenders prevent the staving in of the hull. Folding weather boards at side and ends, tend to keep out the sea. The boat is divided into eight water-tight compartments by transverse bulkheads which carry the deck above the load waterline, thereby making the boat self-bailing by means of scuppers through the bottom of each compartment. A manhole is provided in each compartment for inspection and painting. The boats are tested by actually putting sixty men in them and raising them from the ground or over the water. One of the most important exhibits at the First International Exposition of Safety and Sanitation was a pair of Lundin lifeboats in operation. There are other accessories such as lowering bollards, tilting chocks, etc., which concern the naval engineer rather than the lay public.

The SCIENTIFIC AMERICAN Medal was awarded on the evening of December 12th, at a banquet given in the great ballroom of the Waldorf-Astoria, New York. Dr. Finley presided. Dr. William H. Tolman, director of the American Museum of Safety, showed interesting slides of this and other medal-winning devices. There were addresses by Dr. A. T. Hadley and Dr. F. R. Hutton, Surgeon-General Stokes and President Arthur Williams.

The other awards were as follows: The Travelers' Insurance Company medals to the "A. E. G." of Berlin and the New York Telephone Company. The Louis Livingston Seaman medal to the United States Steel Corporation. The Rathenau medal to the General Electric Company. The Harriman medal was awarded to the Southern Pacific Railway, which was operated for five years without the loss of a single passenger's life.

Prof. F. R. Hutton made the presentation. The exposition at the Grand Central Palace opened on December 11th with a large attendance, which speaks well for "Safety First." Some of the exhibits will be described and illustrated in a subsequent issue.

The boat drill on a modern liner, showing the Welin quadrant davits in operation.



Lower deck davits on the "Imperator," an example of good engineering practice.

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Decline of the United States Navy

THE United States Navy is declining. Under the policy of the present administration it is declining at a rate, which, if maintained for the next four years, will place it in the fifth position, below France and Japan, and will reduce the United States from a first-class to a second-class naval power.

We have on our desk a public document, showing the relative position in sea strength of the United States Navy, which is published by the Government at the close of each year, and is sent out for the information of the taxpayers of this country. The document is headed, "Office of Naval Intelligence, Navy Department," and it is prefaced by the following statement: "In order to answer the frequent inquiries of societies and persons throughout the country interested in the maintenance of the navy and its relative strength and importance in comparison with foreign navies, the following information has been compiled." From its tables we learn that Great Britain has built and is now building warships of a total tonnage of 2,591,291 tons; that Germany is represented by 1,228,208 tons; the United States by 921,844 tons; France by 876,155 tons; and Japan by 702,099 tons.

We say that the United States Navy is declining because a comparison of this document with those issued from the same office in previous years shows that, whereas two or three years ago the United States Navy stood second in strength, with a decided lead over Germany, and France and Japan were so far behind this country as to be entirely outclassed, conditions are so far changed that to-day the German navy is one third more powerful than ours in total tonnage, France is crowding us closely for third position, and in three or four years' time, at the present respective rates of construction, Japan will have a navy equal if not superior to our own.

We make these statements unreservedly; for they are based on cold governmental statistics. Anyone who reads these lines is at liberty to write to the Navy Department and secure copies of this document, and probably of those of the few years preceding.

The decline of our Navy, however, is more serious—far more serious—than is shown by these mere figures of total tonnage. The building by Great Britain of the first dreadnought a few years ago established an entirely new rating of naval strength. The all-big-gun dreadnought of the future will be the deciding factor in a naval campaign. More than ever before, the ship and the gun will decide the fight. Our gunners are doing good work in target practice; but the writer has direct evidence that it is no better than that in some other navies, and not nearly so good as is being done to-day in one particular navy. Therefore, in a future seafight the nation that can string out the longest line of dreadnoughts, carrying the greatest number of long-range armor-piercing guns, will win the fight.

Having this in mind, let us see how we stand. Great Britain to-day has built and is building 42 dreadnoughts; Germany, 26; the United States, 12; France, 11; and Japan, 10 dreadnoughts.

We commend to the attention of those members of Congress who waste the time of the nation in foolish talk about the sin of building big guns and ships to carry them, the following indisputable fact, namely, that if, in a couple of years' time when all these ships are completed, the United States Navy should be sent out by this same Congress to meet the dreadnought fleet of Germany in a stand-up fight, it would be doomed, not merely to defeat, but to absolute annihilation! To the small-navy men in Congress, we commend also the consideration that, if they dispatched our fleet to fight either that of France or Japan, we should probably win, but at a cost of loss in ships and damage to those which remained afloat, that would relegate us to the third-rate position occupied by the Russian Navy at the close of the Russo-Japanese war.

The silly talk about "naval holidays," the "criminal expenditure for battleships," the "combination of warship building firms to promote war scares," to say nothing of the unctuous moralizing of the editorial writer who comes late to his desk and is hard up for a subject—all of this and much more is due to a total misunderstanding of the purposes of a national war fleet. The money put into a country's navy is spent for national insurance. To preserve the peace, prosperity and honor of the United States, we are at present investing about *one and a quarter per cent only* of the national wealth of this country in our Navy. Is that a wicked extravagance?

The present deplorable decadence dates from the time, two or three years ago, when Congress refused to continue the policy of building two battleships a year—an addition which our Naval Board had decided was large enough to maintain the navy at a strength sufficient to meet its responsibilities. In two successive years, Congress so far lost sight of its proper function as to play fast-and-loose with this recommendation of its naval experts and cut the appropriation from two battleships to one, although making no corresponding reduction in appropriations for auxiliary ships.

We had hoped that the new Secretary of the Navy, whose work as the Editor of a paper should, at least, have developed in him the habit of taking a broad point of view on all subjects, and especially on those of a national character, would have loyally followed the policy and adopted the attitude of his able predecessor, and bent his whole energy to restoring the *material* strength of our navy to that standard which the Naval Board had so wisely advised. This he has failed to do; and in his recent recommendations to Congress, instead of asking for the four battleships decided upon as necessary by the Naval Board to repair the deficiencies of the two previous years, he is asking for two only. Mr. Daniels lacks a true perspective and a proper sense of proportion. We wish that his eloquence on behalf of his pet idea, good as it is, of making our warships more than ever schools of training for young men, had been directed to hammering into the heads of Congressmen the really big facts of the naval situation as we have outlined them above.

It has been the privilege of the writer to live aboard ship for extended periods and get into quite intimate touch with the seamen and marines. He found them to be a remarkably intelligent and well educated class of young men, who, while they fully appreciated the opportunities for instruction (now afforded and proposed to be extended) offered by enlistment, were far more interested in the question of the hitting power of their particular ship and the ability of the fleet as a whole to "whip" any equal fleet to which it might be opposed.

The SCIENTIFIC AMERICAN is heartily in favor of everything the Secretary can do within reason to render the life of the enlisted man attractive and uplifting, but we cannot but feel that in the promotion of this particular object, Mr. Daniels is losing sight of the larger things, and failing in that broad information and statesmanlike point of view, which should be the indispensable characteristics of the head of this great institution.

The Scientific American in Our Schools

FROM its very first number, published nearly seventy years ago, down to the very last, the SCIENTIFIC AMERICAN has been essentially a periodical of instruction, and, we hope, a distinct educational force in this country. As a scientific newspaper it has endeavored to set forth simply and accurately the achievements of technically informed men, the world over. So rapid is the march of science, engineering, and industry that the textbook of to-day is all but obsolete to-morrow, and so enormous is the amount of material presented to learned societies for consideration, that even university lecturers find it difficult to keep abreast of the advances made in their own special field. Only a popularly worded periodical, which exists for the sole purpose of digesting the results of scientific investigation and of presenting them in such form that the layman may read them understandingly can really supplement the class textbook. In the course of time the SCIENTIFIC AMERICAN has become, as a result, something more than a journal to be read during an idle hour. It has become in truth a kind of popular illustrated weekly, encyclopedia of technology, and as such it is treasured in permanent bound form not only in the libraries of the more important schools and universities in America and Europe, but in the libraries of manufacturers, business men and those who take a general interest in science.

We are impelled to make these observations because of the extensive editorial correspondence which ensued while our contest "What are the Ten Greatest Inventions of Our Time?" was in progress. To be sure we knew that many a young man has received his first accurate impression of the vast world of industry from the pages of the SCIENTIFIC AMERICAN, and that many a boy with a natural bent toward science or engineering was encouraged by its pages in clinging to the belief that among the ranks of professional engineers, physicists or chemists, he could accomplish his life work most successfully. But we did not know, as the correspondence revealed, how very extensively the SCIENTIFIC AMERICAN is employed by teachers in their class rooms. One instructor made the articles in the journal the subject of weekly essays to be written by his pupils; another used it to illustrate lectures; a third (and it seems that there are many like him) selected the more important articles as they appeared from week to week for class room discussion. The subject of the contest "What are the Ten Greatest Inventions of Our Time?" lent itself peculiarly well to class room work. No two thinking human beings are quite in accord on the ten greatest inventions of our time. Veritable debates apparently ensued in many schools throughout the country, if we may judge by the votes of pupils on the subject taken by school teachers.

The gratifying interest which was shown in the contest leads us to ask school teachers if the SCIENTIFIC AMERICAN cannot be made even more effective for school use than it is at present. While the point of view of an editor—particularly the editor of a popular scientific journal—is not unlike that of a teacher in many respects, nevertheless the suggestions of teachers should prove highly illuminating. The Editor of the SCIENTIFIC AMERICAN would therefore appreciate it if those teachers who are in the habit of using the SCIENTIFIC AMERICAN more or less regularly in their work would set down their thoughts on the subject and send them to him.

Napoleon and Science

WE think of Napoleon as the great Lord of War, the butcher of human lives, the builder of a great empire, built only to fall even before the death of its founder.

It is well to remember that his genius was great in also other, more lastingly fruitful fields. He was not only a great warrior, but also a great statesman—and as such he did not fail to realize the importance to the community of arts and sciences.

Writing to the astronomer, Oriani, from Milan, which he had entered in triumph, Napoleon said:

"The sciences which do honor to the human mind and the arts which embellish life and perpetuate great achievements for posterity, should be especially honored under free governments.

" . . . I invite the scholars to meet and to give me their opinions as to the means that should be taken, and the needs to be fulfilled, in order to bring new life and activity into the sciences and the fine arts. Those who wish to go to France will be received with distinction by the government. The French people set a higher value on the acquisition of a skilled mathematician, a celebrated painter or a distinguished man of any profession, than upon the possession of the largest and richest city."

A Remarkable Aerial Cableway, about 75 miles long, is soon to be built across the mountain barriers separating the famous Vale of Kashmir, in the Indian native State of Kashmir, from the plains of the Punjab. It will be by far the longest cableway in the world, says a consular report on this subject; the longest at present being one of twenty-two miles in Argentina. The plan of constructing an ordinary railway into Kashmir has been pronounced impracticable on account of the loose conglomerate nature of the soil in this part of the Himalayas, which causes innumerable slips and the falling of huge boulders with every heavy rain. The present carriage road into Kashmir, extending about 200 miles between Rawalpindi and Srinagar, was only built with the greatest difficulty, and with much loss of life due to slips; while its maintenance costs the Kashmir government about $500 a mile per annum, chiefly spent in repairing slips and bridges. The projected cableway is likely to cost about $1,500,000, and will be operated by electricity generated by water power at a station near Rampore. It will be constructed in big spans of about 800 yards each, with fixed cables upheld by iron pillars or towers of lattice work, some of which will be 100 feet high. It is expected that goods will be transported between Rawalpindi and Srinagar by the aerial route in 15 hours, whereas the present time, by bullock cart, is 15 days, even under the most favorable conditions of weather.

Engineering

Experimental Fireproof Trains.—The Great Western Railway Company has put in service two experimental, fireproof trains, each consisting of four cars. The cars are built entirely of steel, and they are lighted throughout electrically. Wood has been practically eliminated from these trains. The only wooden construction is the foot-board on the outside,

Railway Accidents in America.—During the first quarter of 1913, 158 persons were killed and 3,628 were injured in train accidents. In other than train accidents, including accidents to employees and to passengers and trespassers, 2,086 were killed, and 17,194 were injured. Industrial accidents on railroads, not involved in train operations, accounted for 97 killed and 26,812 injured.

Marines as Enginemen and Trainmen.—Under instructions from the War Department, marines from the marine barracks, Camp Elliott, I. C. Z., Panama, are plying to and fro on the regular passenger train engines of the Panama Railroad, armed with letters requesting engineers to give them all possible instructions relative to engine running, etc. This movement is being inaugurated for the purpose of having men in the marine service who can be promptly put in on railways in an enemy's territory to handle motive power and trains for the transportation of troops and provisions.

The Great Railway Tunnels of the World.—The world's greatest tunnels are to be found in Europe, and a brief summary of these in the *Engineer* shows that the greatest is the Simplon which is 12¼ miles in length. Two, the St. Gothard and Lotschberg, are over 9⅓ miles in length. The Mont Cenis is a little over 7 miles in length. The Arlberg, in Austria, is 6¼ miles long. There are four tunnels between five and six miles in length, five between four and five miles in length, seven between three and four miles, and sixteen tunnels that are over two miles long. The longest tunnel in this country, the Hoosac, is four and one third miles long.

Lunch-counter Railroad Cars.—Few improvements of late years affecting the convenience of the railway passenger are more important than the innovation now being made by the Pennsylvania Railroad in running between New York and Philadelphia a steel lunch-counter car. All travelers between big cities on important fast trains can bear testimony to the inconvenience of waiting for a seat in the dining car. The lunch-counter car will be a great saver of time, and will obviate much inconvenience and irritation. It is 80 feet long and has a mahogany counter running half its length. Twenty-one persons can be seated, and the counter has every convenience, even to a cigar humidor.

Subway Line for Milan.—The principal cities of Italy are considering the matter of installing subway lines in order to handle the ever-increasing traffic. We have mentioned the recent project for a subway of some length at Naples, and it is now stated that the city of Milan is considering the feasibility of running a subway line. The municipality appears to be in favor of the new scheme, especially because in the inner part of town there are many narrow streets which hinder the proper extension of surface traction lines. One drawback toward carrying out the engineering work on the tunnel is that the subsoil is not of a very good character for this kind of an enterprise, so that some special measures will probably need to be taken.

Giant Coffer-dam for the Equitable Building.—A vast reinforced concrete monolithic foundation is being built entirely around the area upon which will be erected the new Equitable Building in this city, a structure which will contain one million square feet of rentable floor space, and will tower aloft to a height of thirty-six stories. The coffer-dam will be a solid concrete wall, six feet broad and eighty feet deep, extending eighty feet to solid rock. This will be the largest office building yet constructed. It will weigh over 200,000 tons as against the weight of 103,000 tons of the Woolworth Building, 188,500 tons of the Municipal Building, and 82,580 tons of the Singer Building. The steel framework alone will weigh 45,000 tons, as against 25,000 tons required for the Woolworth Building.

The Most Powerful Electric Locomotives.—The New York Central Railroad is having built for its terminal electric service six electric locomotives which will be the most powerful yet constructed. They will be capable of developing 2,000 horse-power continuously or 2,600 horse-power for one hour. The equivalent tractive effort is 14,000 pounds at 54 miles per hour continuously, or 20,000 pounds at 49 miles per hour at the one-hour rating. Each locomotive can haul, if necessary, a 1,200-ton train on level track, continuously, at 60 miles per hour. They are insulated for 1,200 volts to enable them in the future, should it be desired, to operate on this voltage. They are being built by the General Electric Company at Schenectady. They have a higher efficiency than any other high-speed electric locomotives yet constructed.

Science

The Next International Geological Congress will meet in Brussels in 1917.

The 1914 Meeting of the American Association for the Advancement of Science.—The American Association for the Advancement of Science will hold its next convocation week meeting in Atlanta, Ga., from December 29th, 1913, to January 3rd, 1914, under the presidency of Dr. Edmund Beecher Wilson, of Columbia University.

C. Francis Jenkins Awarded the John Scott Medal.—The Franklin Institute of Philadelphia has just announced the award of the John Scott medal to C. Francis Jenkins of Washington, D. C., for recent achievements in motion pictures. This is the second award by the Institute to Mr. Jenkins for original research in this art, the first being an award of the Elliott Cresson gold medal (1895) for the discovery of a successful method for projecting motion pictures on a large canvas; which subsequently made possible the thousands of theaters in which photo plays are produced. Much of his old experimental apparatus was acquired by the National Museum some years ago, and is now on exhibition in the Grafic Arts Section.

Standard Adopted for Weighing Precious Stones.—In a circular recently issued by the Bureau of Standards, Department of Commerce, announcement is made of the recognition by the Bureau after July 1st, 1913, of the metric carat of 200 milligrammes as the standard of weight for diamonds and other precious stones, and this standard will be used in the certification of all carat weights submitted to the Government for certification after that date. The Treasury Department also adopted this standard on the same date for use in the customs service in levying the duties on gems. The change from the former uncertain and indefinite carat weight, usually equal to about 205.3 milligrammes, to the definite and simpler metric carat was made possible by the joint action of all the large dealers in diamonds, pearls, and other precious stones, who, realizing the chaotic condition due to the various weights used as a carat, decided upon the metric carat as the solution of the difficulty and agreed to put its use into effect on the same date. Not so long ago nearly every civilized country of the world used a different standard of weight for diamonds, the article above all upon which there should be the best agreement as to the unit of weight because of the great value of the commodity. Recently the movement for uniformity in the standard rapidly gained ground, and Spain, Italy, Bulgaria, Denmark, Norway, Japan, Portugal, Roumania, Switzerland, Sweden, France, Germany, Holland, and Belgium, with the United States, are in the list of those countries which now use the new international standard. England is the only country of importance in which the change has not as yet been made, but considerable progress toward that end has been made even in that country.

The American Women's Table.—The Naples Table Association for Promoting Laboratory Research by Women was founded in 1898. It maintains a research table at the Zoological Station at Naples for qualified women students and since 1893 has offered every two years a research prize of $1,000. The Zoological Station at Naples was opened by Prof. Anton Dohrn in 1872 for the collection and study of biological material. It has developed into an international institution offering opportunities for independent research in general biology and physiology. Dr. Reinhard Dohrn is the present director. The station provides all material free of cost and the American Women's Table is well equipped with necessary apparatus. The Table is sometimes used by four or five research students in the course of a year. The Ellen Richards Research Prize of $1,000 is offered periodically for the best scientific thesis, written by a woman, embodying new observations and new conclusions based on independent laboratory research in biological (including psychological), chemical, or physical science. The seventh Ellen Richards Prize of $1,000 for the best thesis written by a woman, on a scientific subject, must embody new observations and new conclusions based on independent laboratory research in biological (including psychological), chemical, or physical science. The theses offered in competition are to be presented to the executive committee of the association and must be in the hands of the chairman of the committee on the prize, Dr. Lillian Welsh, Goucher College, Baltimore, Md., before February 25th, 1915. The title page of each manuscript must bear an assumed name; and the writer must send with her manuscript a sealed envelope containing her application blank and superscribed with her assumed name. The association reserves the right to withhold the prize, if the theses presented are not, in the judgment of the regularly appointed board of examiners, or by such specialists as they may choose, of adequate merit to deserve the award. The decision will be announced at the annual meeting in April, 1915.

Automobile

A Novel License Tag.—An automobile tag, the body of which has a particular color indicating units of one thousand or more and upon which a number is produced indicating units of nine hundred and ninety-nine or less, has been patented by Abram Wakeman of New York city, patent No. 1,073,004.

An Automobile Funeral Car.—In a patent, No. 1,072,864, Ida Schmidt Marvin of Detroit, Mich., presents a funeral car in which a compartment to receive a casket is located in rear of the space for the chauffeur and a large compartment is provided in the rear of the casket space for passengers.

A Convertible Automobile Body.—Patent No. 1,072,394 has been issued to Frank E. Plummer of Washington, D. C., assignor of George C. Plummer of the same place, for an automobile body and presents in connection with a fixed front seat, a rear section having a removable seat and conventional sides and doors and slidable on the chassis to telescope the front seat, so that the body may be converted from a roadster into a delivery or touring car.

A Simple Tire Tube Tester.—The patent No. 1,071,124, to Dover Stamping and Manufacturing Company of Portland, Maine, assignor of Horace E. Whitney of Cambridge, Mass., shows a tube tester whose tank has its bottom curved in vertical plane and a rod adjustably connected to the tank extends upwardly and has its upper end bent to form a hook on which the tube may be suspended and along which it may be moved in moving the lower part of the tube through the water in the testing tank.

Good Roads, Electric Lighting and the Central Station.—When modern good roads are really built and properly equipped they should be provided with electric lighting, to enable them to be safely traversed by night as well as by day, and when the electric wiring for lighting purposes is installed, it will bring with it abundant opportunity for equipping numerous stations where batteries may be charged and held in readiness for every caller. The demand for current thus provided during the non-peak period of the day would simplify very materially the financial element in the equipment of the road with electricity, and, when combined with the ultimate business of supplying residents along the route with light and power, should lead to a most extended development of the electrical industry. It must be remembered that although the kinematograph was well known for many years, the immense business in operating moving-picture shows was not built up until a systematic and commercial industry in the provision and distribution of suitable films was provided. In like manner the real development of the electric vehicle will depend upon the creation of a systematic roadside equipment of charged and standardized exchangeable batteries, so that an immediate supply of current can be obtained as readily and as cheaply as a few gallons of gasoline. When such a field for business appears before the electrical development industries, it would seem as if its exploitation would depend only upon the time required for the construction and installation of the equipment.

Why Not Interchangeable Storage Batteries for Automobiles?—The relations between the improvement of highways and the extended use of mechanically-propelled vehicles are very generally understood, but it is possible that the influence of the good-roads movement upon the development of the electric automobile is not so definitely perceived. Already the increasing cost of gasoline is narrowing the gap between the operative cost of the two kinds of motive power, and it is possible that improvements in the efficiency and convenience of the storage battery may act still further to bring the power-cost of the two types of machines closer together. There is an element, however, in the supply of electric current for vehicles which needs extended attention, if the possibilities of this type of automobile are to be fully realized. The owner of a gasoline car knows that wherever he may be upon the road, he is not far from a source of fuel supply, and that he needs only to have his gasoline tank refilled to be ready to continue his journey. The charging of an electric battery, however, is a matter of time, and the facilities for securing a supply of current are by no means so good as with the supply of liquid energy; gasoline "juice" is easier to get, and costs less than the electric variety. Two things are necessary to remedy this difference: First, a standardization of electric storage batteries for automobile service, providing, say, three different sizes, so unified in dimensions and fittings as to be capable of immediate replacement for the exhausted battery in the corresponding type of vehicle; and, second, an abundant supply of stations where such batteries, ready charged, may be obtained without delay, in exchange for the run-down battery, upon a payment corresponding to the amount of electric energy delivered. Such batteries should be as interchangeable as milk bottles, and at as many points.

Inspecting Track Scales for the United States Government

New Test Car and Equipment of the National Bureau of Standards

By Herbert T. Wade

THE United States Government, through its Bureau of Standards of the Department of Commerce, recently has put into service a special standard test-weight car designed especially for testing the track scales on railways and the weighing equipment of grain elevators and other establishments where commodities are weighed in bulk for the benefit of the general public, which unlike the great corporation is rarely able to protect itself by official tests of the scales or weighing mechanism on whose indicated weight they pay freight or purchase commodities in bulk. This test car differs from those customarily employed on American railways in that the test weights are more carefully standardized and are used with a test truck only when the scales are under examination, instead of the truck, car and weights together forming the test weight. This has involved a special form of construction and equipment which was especially designed for the Government after general plans by L. A. Fischer, chief of the Division of Weights and Measures, and C. A. Briggs, assistant physicist in charge of the car, by A. H. Emery of Glenbrook, Conn., well known as the designer and builder of the famous Emery testing machine of the Bureau of Standards.

The test car, which was built by the American Car and Foundry Company at Wilmington, Del., and then equipped by Mr. Emery is unique in many respects. In appearance it resembles an ordinary automobile car, on which, in fact, it was patterned, being of first-class non-collapsible construction, with United States standard equipment. It cost the Government $14,000 complete, the testing equipment representing a much greater expense than the car itself, and with its various appliances it is really a most thoroughly worked out mechanical laboratory for the purpose intended. With equipment the car weighed complete on the scales 172,720 pounds at Bridgeport.

It is rated at a capacity of 100,000 pounds according to railway standards and has an inside length of 40 feet 5 inches, an inside width of 8 feet 10 inches, an inside height of 9 feet 1 inch, a height at eaves of 12 feet 10 inches, and a width at eaves of 9 feet 2 inches. It has a coupler shank 5 by 7, yoke attachment, K2 triple-brake valve, No. 2 metal beam, and Westinghouse draft gear.

The interior of the car is divided into two compartments. One where the standard weights and truck for their carrying as well as the crane for handling them are located and a smaller compartment in which are installed a gasoline driven electric generator of 10 kilowatts capacity supplying power for an overhead hoist, for the truck carrying the standard weights on the scales, and current for the lighting circuit of the car, there being also a small storage battery for this last purpose when the generator is not running. It further affords accommodations for the inspector and his two assistants.

The principal feature of the equipment are the test weights, which are special castings of selected iron whose weight has been ascertained with high precision. These include eight 10,000-pound weights and four 2,500-pound weights, large blocks or slabs of iron which when the car is in motion are held rigid, bolted firmly to a framework. There are also cases carrying an aggregate of 10,000 pounds in 50-pound weights to be used in testing wagon, stock yard, grain elevator or other scales, the car carrying a complete equipment for testing, examining and sealing all of the various types of scales and their weights of large capacity.

The standard weights and also the cases of separate weights are fitted with a special recess or socket in which a coupling connected with the cable of the overhead hoist can be inserted and the weights raised by the tackle with safety and expedition. These weights were standardized by first securing a series of 50-pound weights calibrated at the Bureau of Standards, which were used to derive a series of correct 50-pound weights. These having been secured, the 2,500-pound weights were then calibrated, and these in turn were checked against each other and were used to standardize the 10,000-pound weights, so that when finally adjusted, correct on an average to one tenth of a pound in 10,000, they showed that the 90,000 pounds of large weights were correct within an error of one pound or one part in 90,000, which is far more accurate than the tolerance for the highest class of standard weights tested by the United States Bureau of Standards.

The hoist by which these weights are handled is the leading mechanical feature of the car. The track or girders from which the crane operates is carried just under the roof of the car by special arches in its framing. Normally this is stowed entirely within the car, but when a test is to be made the large doors at the end are opened and the beams are slid out so that they overhang the end of the car sufficiently to enable the truck to be lifted out from its position within the car and the various weights as desired to be placed upon it according to the test amount desired.

The hoist, of course, travels along the overhead rails, picks up truck or weight and transports it out above the track, where the load may be set in position, the power being supplied from the generator and the control effected by various switches, rheostats, and ropes. When it is realized that weights of 10,000 pounds must be handled safely and speedily the care with which the overhead crane was designed is apparent, for the entire series is loaded or unloaded on the truck well within 30 minutes.

The truck, which also is carried within the car, bolted rigid to a wooden framework when not in use, is a six-wheel carriage designed to carry the test weights. It has a 5 horse-power electric motor, which can be supplied with current from the generator through a portable, flexible conductor and by means of a worm and gear from motor to axle the truck can be moved along the track and take any position desired along the track scale or the adjoining rail.

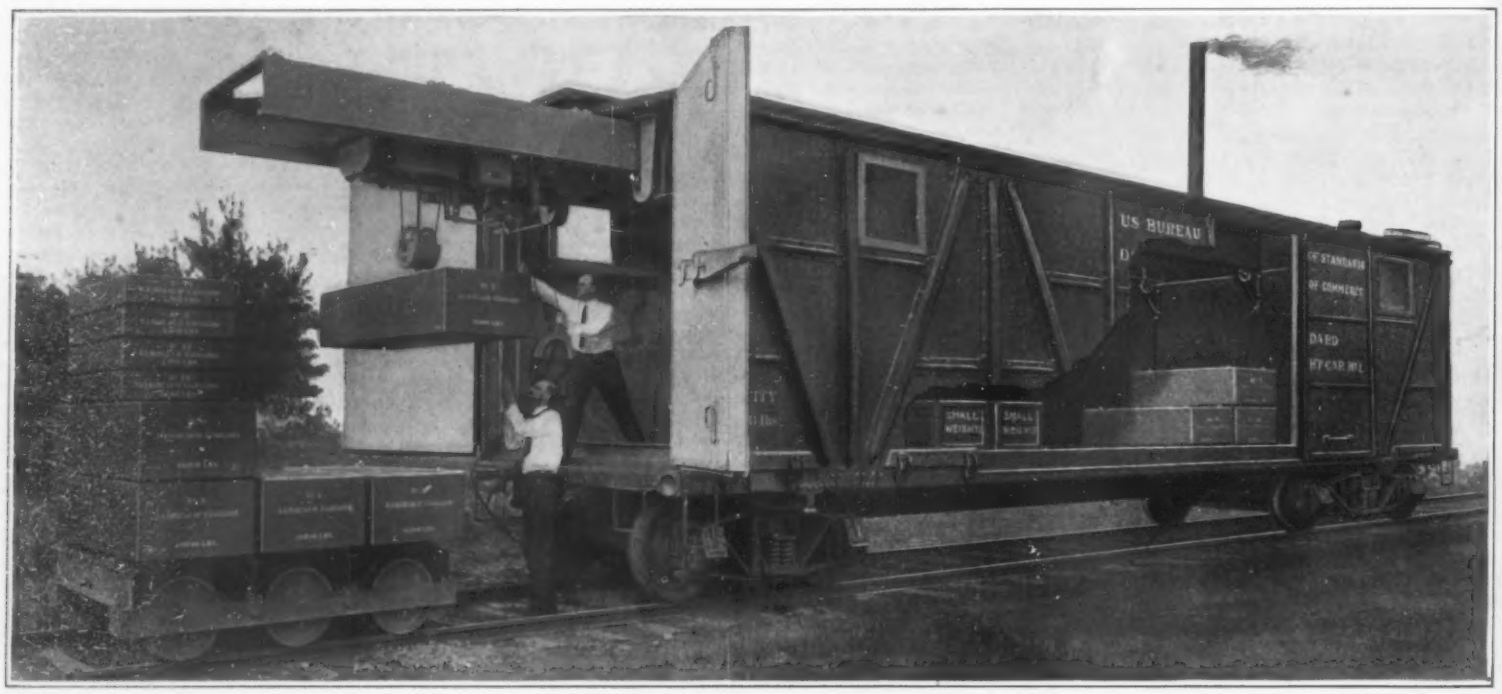
This truck, which has a wheelbase of 60 inches, weighs 5,060 pounds and can be used as a test weight itself, but if the highest accuracy is desired it is first weighed on the scales over the various sections to be tested and then the standard weights are added and the truck and its load is placed again on the scale and the weight of the truck subtracted from the reading of the beam. It is not even necessary to use the truck, for the standard weights could be deposited directly on the track scales, but the truck is most convenient as track scales are usually tested by placing the standard weights over each of the various sections or bearing points successively and noting the variation in reading.

The functions of the test weight car are considerably more extended than the ordinary test weight cars of the railroads due to the more elaborate equipment and the conditions under which it is operated. The new car furnishes properly authenticated weights of large denominations, hitherto lacking, which serve as standards to standardize other large weights by direct comparison. It affords opportunity to test the accuracy of large capacity scales and weighing machinery used in commerce and industry, by direct application of its standard weights. It also enables the master scales used in establishing the weights of the test cars of the various railroads to be accurately standardized, and an examination to be made of track and other large scales as they are maintained by tests either simple or complete.

With the new car the Government officials hope to determine the equipment and tests required properly to test, adjust and maintain large scales, as well as study the mechanical action of the scales in relation to their proper design and character, and especially as regards their rating, for it is believed that the numerical rating of many scales is far in excess of their actual capacity. It is further the intention of the Bureau of Standards to study the question of scale specifications for the proper design and purchase of scales by the Government and private individuals and to study weighing methods and conditions in general with a view to the elimination of those factors which are conducive to mistakes and bad weighing practices. Finally to determine what variations are to be expected with the different commodities and to secure statistics and other information for the determination of proper tolerances in scales and weighing.

With these ends in view the Bureau of Standards' test car has just made its initial trip through New England and preliminary results have more than justified its acquisition by the Government. There has resulted a general overhauling of track scales in this territory and the importance of the subject has been forcibly im-

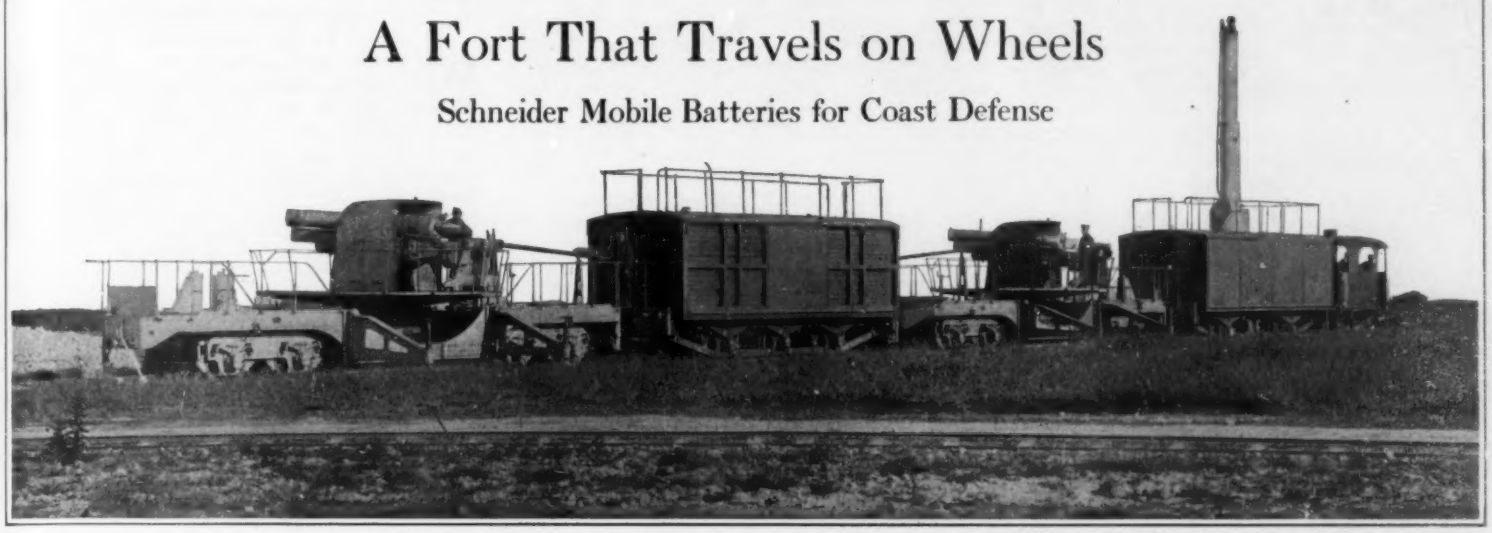
(Concluded on page 482.)



Inspecting track scales for the United States Government.

A Fort That Travels on Wheels

Schneider Mobile Batteries for Coast Defense



In the center is the ammunition car; on each side are the two guns; and to the right is the observation car.

THE COMPLETE SCHNEIDER COAST DEFENSE TRAIN AS BATTERY

MOBILE batteries running on rails are well qualified to defend a long line of coast. Their use renders it possible to do away with batteries which it would be otherwise necessary to provide for the defense of areas included between the principal defensive fortifications. By reason of their great mobility, these batteries can be rapidly moved to points where it is necessary to reinforce the defense, to enter immediately into action, or to withdraw, either because they may be required elsewhere or to escape a well-directed fire.

The temporary consolidation of a certain number of guns will constitute a kind of movable fort, powerful and very economical. The mobility of the batteries will be a protecting element far more efficacious than the ramparts of permanent forts, upon which, because of the advanced position of the outworks, the fire of an enemy can be concentrated.

In addition to these various advantages, mobile batteries present other merits, the principal ones of which are:

(*a*) Since the mobile batteries can take the place of fixed coast batteries of the same offensive power, but of much more costly construction, there is great economy in the preparation of the defense. It is necessary merely to provide a railway.

(*b*) Complete secrecy of the plan of defense, since the placing of a battery in position is not betrayed by preliminary work.

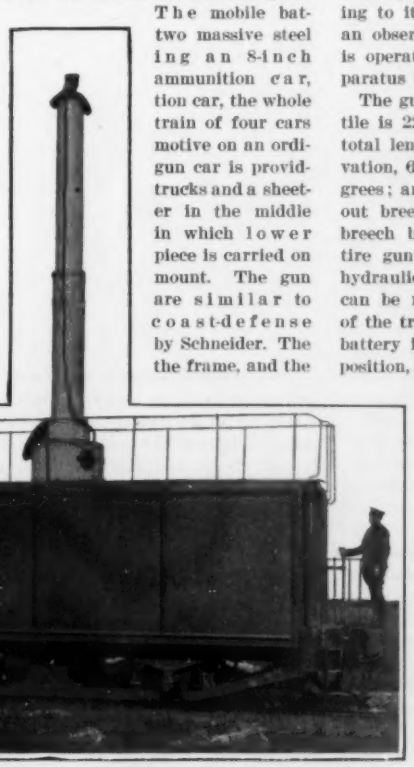
(*c*) A better utilization and economy of material, since the guns will not be uselessly stationed in fixed positions in permanent work.

(*d*) The material can be more easily kept in condition; for in time of peace the batteries can be stored under cover and sheltered from intemperate weather.

(*e*) It will be unnecessary to establish strategic roads for conveying siege or field artillery material on wheels.

(*f*) The railway can be employed for other purposes than those of the artillery. Thus in time of war it can be used for the rapid transportation of infantry and the conveying of the necessary ammunition to the defending batteries; and in time of peace for the economical development of the coast by the transportation of merchandise and passengers. The system herewith illustrated has been developed by Schneider & Co., the well known makers of armor and guns.

The Battery.—The mobile battery consists of two massive steel cars, each carrying an 8-inch rapid-fire gun, an ammunition car, and an observation car, the whole constituting a train of four cars drawn by a locomotive on an ordinary railway. The gun car is provided with two bogie trucks and a sheeted steel platform, lower in the middle than at the ends, in which lower part the 8-inch piece is carried on a central swivel-mount. The gun and its carriage are similar to other modern coast-defense weapons designed by Schneider. The body of the car, the frame, and the brakes are all similar to the corresponding parts on the ammunition car.



Observation car with fire-control officer at the top of telescopic mast. Note telephone connection.

The observatory consists of two movable tubes, telescoping one within the other, and of a short, fixed section of tube carried on the car itself, and extending down to the frame. The fixed tube section serves to guide the movable sections. The movable tubes are telescoped into the fixed tubes when the train is traveling to its destination. The smaller movable tube has an observation platform at its upper end. The tower is operated by means of a hand-operated hoisting apparatus within the car.

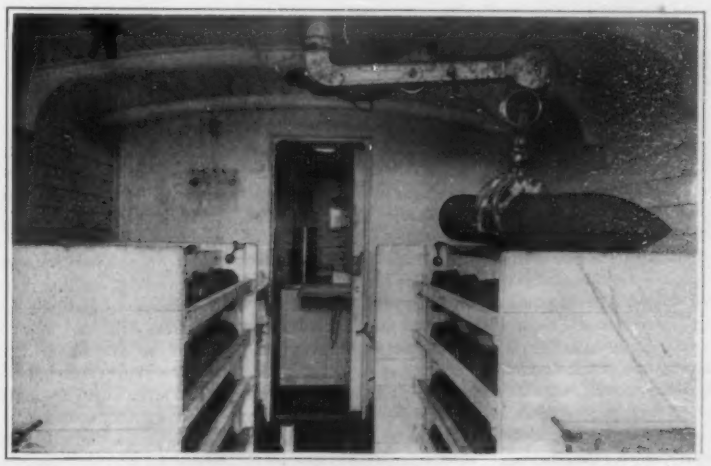
The gun has a caliber of 8 inches. Weight of projectile is 220 pounds; initial velocity, 1,400 foot-seconds; total length of the gun barrel, 11 feet; maximum elevation, 60 degrees; maximum depression minus five degrees; arc of fire, 360 degrees; weight of the gun without breech blocks, 3,560 kilogrammes; weight of the breech block is 140 kilogrammes; weight of the entire gun mounting and car, 1,145 kilogrammes. The hydraulic recoil brake is so constructed that the recoil can be readily taken up by the truck and the rails of the track. The mechanism for returning the gun to battery is sufficiently powerful to bring the piece into position, even when the gun is trained at the maximum angle of fire. The side members of the platform carry two articulated swinging supports, the outer ends of which carry screw-adjusted base plates, which are employed when the gun is swung around with its longitudinal axis at right angles to the length of the car. Ammunition is served to the gun by means of a small carriage, which runs on a circular rail surrounding the piece.

The Ammunition Car.—The ammunition car is placed between the two gun cars in the train, so as to supply both pieces with projectiles. The projectiles are stored in racks arranged within the car in a horizontal position. The car is armored with plates one inch in thickness.

The Observation Car.—The observation car is usually coupled directly to the locomotive. From this position the commanding officer can place his guns in the most favorable positions, or to select a more advantageous point of observation.

The observatory at full extension provides an excellent platform for spotting the fall of the shots.

Eight-inch rapid-fire gun on car with steadying arms swung out into position.



Interior of ammunition car; crane picking up shell from the shell rack.

Flying for Altitude Records

By C. Dienstbach

ONE of the most puzzling problems in physics for the layman is the climbing ability of an aeroplane. Nor do daily papers—or aeronautical magazines, at that—ever explain just why it was so difficult for Mr. X to fly the hundred feet higher than Mr. Y, for which they praise him so freely.

Throwing some light on this question means, incidentally, elucidating some of the dark corners of the whole vexed problem of flight, which, after ten years of aeroplaning, does not yet seem to be understood as well as it should be.

Credit is due to the aviator who breaks an altitude record on two grounds: First, that he has the skill instinctively to fly his machine under the most favorable physical conditions and to "get out all there is in it"—in other words, always to choose an angle of his planes that wastes least power. Not many people realize how much superfluous power and fuel may be uselessly expended in flying; for it would take complicated calculations theoretically to define the most economical angle of the planes under varying conditions of air and wind, and for a given type and condition of machine and motor. It is an important element of the makeup of a successful aviator that he intuitively feels what angle is best at a given moment, and, incidentally, how he must move his rudders and controls that they, too, attack the air at the most economical angle. In the birdlike aeroplane of the future, with "feathering" propeller blades, it will be still more important to adapt the angle of the propeller blades to changing conditions.

The second achievement for which credit is due to the pilot is purely human—to have retained full command over his faculties under the intense discomforts of very high flying. With many pilots these include something closely akin to dizziness; but all suffer from the Arctic cold and the rarefied air, though this could be eliminated by heating and oxygen.

But why is it so difficult for the instrument, the machine, to fly high? Simply because it is so difficult to fly at all, because the air is so thin and light. If it were as thick and heavy as water, we would need no wings and motors; we could swim in it with our mere legs and arms. But because it is thin, we need large wings—to get hold of much at a time—and we need strong motors, because such wings are so difficult to make light and strong, and must be supported by so many wires and struts, that it takes great power to move all these encumbrances speedily through the air. And speedily driven they must be, because otherwise the wings would have to be of a size wholly impracticable.

Now if the air becomes twice as thin and light at a certain altitude, all these difficulties of flying become exactly doubled. To fly with the same power at an altitude where the weight of the air is only half as great would render it necessary that the area of the propeller blades of the supporting planes, and last, though not least, of the rudders and controls, be exactly doubled without either increasing their weight or the thickness and number of the wires and struts necessary to support them. Obviously, we cannot do this; and it follows, therefore, that any ordinary aeroplane becomes a "racing machine" with "abnormally reduced" wing area, as soon as we mentally place it in such thin air. In short, it behaves as though we had halved the area of its wings, its propeller blades and its controls, without increasing its motive power, and now wanted to fly it near the ground. If the machine has been designed, let us say, with so much surplus lift near the ground for extra passengers and great stores of fuel, that it can still fly with one man and little fuel after having all its surfaces reduced one half, it is certain that it can climb in its normal condition, and with one man, to an altitude where the density of the air is half that at the ground. Incidentally, if there becomes a racing machine—its speed is just as much increased as it would be at the ground, if the wings were reduced to half their size. But not fully, because racing machines for good reasons are not in the habit of reducing the area of their propeller blades as well. It was the large blade area and relatively small wing area which made the "Baby Wrights" at Belmont Park in 1910 look more like "helicopters stood on edge" than aeroplanes.

Thus far we have not considered the "altitude troubles" of the motors, because these are more of an "aerostatic than an aerodynamic nature." To preserve the same power in the motor with the air's density reduced one half, would also require doubling the cylinder volume, other conditions, such as the quantity of fuel for each stroke, being equal. In the same size of cylinder, only half as much fuel can be consumed per stroke at such great altitudes as at the level of the ground. But carbureters in which the amount of fuel per stroke depends on the energy (and, consequently, density) of an air jet, regulate this proportion more or less automatically.

There is still another way to look at the physics of high flying, though not quite as efficient in guarding against confusion and sophistics: the lift of an aeroplane is always a fixed ratio to the pull of the propeller, or the drift. If the air's density is one half, the propeller must run much faster to get the same pull; for, in the propeller the pull is likewise a fixed ratio of the "drift" of the blades, or the turning effort of the motor. This shows at once how a propeller must necessarily race at great altitudes, and why Garros broke a connecting rod while making a new height record. But why would a larger propeller not save all extra effort of the motor? Here is just one of the sophisms to which, for instance, some critics of Prof. A. G. Bell have fallen victim, when he suggested racing from America to Europe at the height of several miles—quite an absurd proposition. It does help, surely; a large propeller is always good, as the Wrights have demonstrated for all time. The writer expects larger propellers with blades feathering at will during flight (and reversed in safe landings). Enlarged rudders, whose usefulness has been so well demonstrated by Pégoud, and the angle of the planes adjustable against the fuselage or body (or rather the line of the propeller's pull), as tried by Gallaudet for a short start and sudden increases of lift, may become standard features of the "birdlike" aeroplane of the future, but it does not help enough. It only prevents the slip from increasing in the thinner air. If weight did not prevent carrying more than two large propellers side by side, after the Wright plan, the slip might even be practically eliminated. But even then, if we should imagine the aeroplane propelled by a windlass quickly winding in a cable fastened to the top of a high mountain, thin air causes an increased consumption of power, because it makes the aeroplane lose its resistance against propulsion. If it does not offer a drift of 200 pounds at 45 miles an hour it will likewise not lift 900 pounds at 45 miles an hour, and the motor must propel it so much faster that the increased speed finally creates the same drift of 200 pounds in the thinner air. Not considering any slip of the propeller, which only makes matters still worse, the motor must now lift "by the windlass" 200 pounds 88/100 instead of 75/100 miles every minute. In Germany these natural laws are now so clearly understood that a method has been found by which the maximum height an aeroplane can reach is quickly calculated from the amount of overload it was found able to carry in weight lifting tests near the ground.

An Object Lesson in Road Maintenance

IN order to demonstrate the value of practical maintenance of highways, the American Highway Association, the central good roads organization of the United States, has arranged, in co-operation with the Federal Office of Public Roads, and road officials in Virginia, North Carolina, South Carolina, and Georgia, for an ambitious maintenance experiment on the road from Washington to Atlanta, Ga. Over seven hundred miles of road are expected to be improved and kept in condition as a result of the initiative of the American Highway Association. The experiment is on a larger scale than any maintenance experiment ever undertaken in this country.

The great maintenance object lesson road extends from the capital of the United States through a very historic section of the country, passing such famous points as Arlington, Mt. Vernon, the battlefields of Bull Run, Chancellorsville, Spottsylvania, and Fredericksburg, *en route* to Richmond, thence extending southward through the capitals of North and South Carolina, and terminating at Atlanta.

The American Highway Association will enlist the support of the counties and districts traversed by the road, and, wherever possible, induce the local authorities to place the road under the supervision of Government engineers who will be detailed from the Office of Public Roads for that purpose under the co-operative arrangement.

Probably 75 per cent of the total mileage has already been improved by a surfacing of stone, gravel or a mixture of sand and clay. The object of the maintenance scheme is to prevent the improved portions of the road from deteriorating for lack of suitable care, and to make the unimproved portions as comfortable for travel as possible with the money available.

With the co-operation of all different communities, however, it is hoped that concerted work will be undertaken on the entire stretch of highway, resulting in a continuous maintenance object lesson that will be a stimulus to maintenance throughout the country. The American Highway Association has undertaken to raise the money for the traveling expenses of the engineers who will supervise the work.

Leonard Tufts is chairman of the committee designated by the association to have charge of the campaign, and he has already arranged to place 110 miles under Government engineers. It is expected that all counties traversed by the road will cheerfully enter into the arrangement, as it is a long step toward a continuous stretch of road that will benefit the entire seaboard.

To Our Subscribers

WE are at the close of another year—the sixty-ninth of the SCIENTIFIC AMERICAN'S life. Since the subscription of many a subscriber expires, it will not be amiss to call attention to the fact that the sending of the paper will be discontinued if the subscription be not renewed. In order to avoid any interruption in the receipt of the paper, subscriptions should be renewed before the publication of the first issue of the new year.

To those who are not familiar with the SCIENTIFIC AMERICAN SUPPLEMENT a word may not be out of place. The SCIENTIFIC AMERICAN SUPPLEMENT contains articles too long for insertion in the SCIENTIFIC AMERICAN, as well as translations from foreign periodicals, the information contained in which would otherwise be inaccessible. By taking the SCIENTIFIC AMERICAN and SUPPLEMENT the subscriber receives the benefit of a reduction in the subscription price.

Obituary

HENRY E. MEAD

IN recording the death of Mr. Henry E. Mead among one of the oldest employees in continuous service of Munn & Co. and in connection with the SCIENTIFIC AMERICAN, it is fitting to mention a few of the characteristics that were noticeable during his long career. His death came rather suddenly on the morning of November 25th, 1913, at his residence in Glenrock, New Jersey, in his seventy-fifth year.

He was engaged by one of the original founders of the SCIENTIFIC AMERICAN, Mr. Alfred E. Beach, of the firm of Munn & Co., in the year 1867 as a draughtsman on wood, preparing illustrations of mechanical and similar subjects thereon for the wood engraver of that period to execute. Mr. Mead had a faculty of quickly grasping the essential features of a given subject and bringing them out clearly upon the wood block, which made the resulting engraving equally clear and effective. When it is remembered that during this period, long in advance of the present day of rapid photo-engraving methods, he prepared illustrations of some of the then new discoveries or inventions like the electric light, phonograph, telephone, cable telegraphy, and numerous mechanical inventions, it will be recognized that he covered a remarkable range of subjects. He was a mechanical artist of great care and accuracy, and his work as recorded in the SCIENTIFIC AMERICAN will be of future historical value.

The Current Supplement

IN this issue of the SCIENTIFIC AMERICAN SUPPLEMENT, Messrs. G. A. Burrel and S. N. Seibert describe and discuss the experiments carried on by our Government on the use of small animals, such as mice and canaries, to test mine gases for poisonous constituents.—Prof. E. Trouessart of the French National Museum of Natural History contributes a very interesting article on the question, "Did the Horse Exist in America When This Continent was Discovered by Europeans?"—An important engineering topic discussed is that of the best limits for steam turbine units.—The recently opened Chattanooga hydro-electric power development is illustrated and described.—Alfred E. Waller writes on dynamo electric lighting for automobiles.—A subject which is at the present time receiving a well-deserved interest is that of safety in industrial operations. A valuable report on an investigation of protection devices for grinding wheels forms the subject of a paper read by R. G. Williams, before the American Society of Mechanical Engineers, and published in this week's issue.—F. Donaldson writes on the sinking and lining of shafts.—There is every promise that a new industry will come to America through efforts now being made under Government auspices to raise hyacinths, tulips and others bulbs here, instead of importing them, as has been the custom hitherto, from Holland. Mr. Guy E. Mitchell tells us of this development.—An automatic fire alarm whose action is based on the use of a conductor with a negative temperature co-efficient of electric resistance is described by F. A. J. Fitzgerald.—An article on Aerial Flight, by H. R. A. Mallock among other things exposes a common fallacy regarding the use of pendulum devices for stabilizing aeroplanes.

The Forest Service Fire-lookout

THE Forest Service is somewhat proud of a fire-lookout in the Sitgreaves National Forest in Arizona. The lookout tower is built entirely of logs and projects 115 feet into the air, and was built by the rangers from the logs at hand and with none of the modern hoisting devices, being obliged to rely upon the cow ropes they had at their saddle horns and such blocks and tackle as were available.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Side-slipping of Aeroplanes

To the Editor of the SCIENTIFIC AMERICAN:

In addition to the suggestions on "Prevention of Aviation Accidents" given in my communication published in the SCIENTIFIC AMERICAN of October 4th last, I would like to offer some further ideas on this subject with especial reference to that numerous class of accidents due to side-slipping, as I see there were three such mishaps in Europe quite recently—one at Maidenhead, England, on August 30th, another at Melun, France, on August 31st, and the third in Buckinghamshire on September 22nd—resulting in the death of two aeroplanists and injuries to five others.

It is obvious that the tendency to side-slip is heightened and maintained by the vertical surface constituting the sides of the inclosed fuselage in many late monoplanes, and in fact by all vertical surface below the monoplane's wings, as well as by any excess of vertical surface below the center of gravity in a biplane as compared with the amount above that level. The vertical surfaces inserted just below the upper plane, on each side of the middle, in the later models of Wright aeroplanes and in the Curtiss airboats are presumably intended to offset the amount of lower vertical surface on the forward extensions and on the floats, respectively, and thus prevent the tendency to side-slip due to the latter; but it is doubtful that this is always sufficient.

Now, if vertical surface were provided still higher up in an aeroplane, extending above the top plane, where there is generally a king-post, anyway, in monoplanes, more leverage would be exerted by the same amount of surface during side-slipping for aiding in restoring the machine to an even keel. If such a permanent vertical fin might sometimes operate to disadvantage, as in side-gusts, a horizontally-pivoted Venetian-blind surface, normally open, or an extendable and reefable curtain, or series of curtains, might be used instead, such surfaces being instantly convertible into a vertical fin when needed to prevent side-slipping, as in banking during turns.

An even more efficient device for preventing side-slipping, and one that could be used either alone or in conjunction with the foregoing, would consist in dihedral surfaces of about 45 degrees angle situated at each lateral end of the aeroplane and preferably extending both above and below the outer tips of the planes if in the form of Venetian blinds or extendable curtains, but extending only above the planes from the tips if in fixed form as dihedral surfaces; and if these latter would cause trouble in side-gusts the situation could be bettered by having them normally in vertical position, extending half above and half below the wing surface and pivoted in the middle so as to be instantly turnable, with little effort, to the 45-degree angle at both wing-tips in case of side-slip threatening or occurring.

Besides, such vertical or dihedral surfaces at the planes' lateral ends would be of value by helping to conserve the air-rarefaction on the top side of the planes at the tips and thus give increased life to compensate for their added head resistance and weight; for flying machine designers are at last coming to realize that this air-rarefaction on the tops of planes is a valuable contributor to lift efficiency.

Inasmuch as these vertical and dihedral surfaces need not be at all large in order to accomplish their purpose, on account of the leverage they exert, and as they could be so easily added to even existing machines, it would seem to be the part of wisdom to so equip all aeroplanes; for it is still too true that aviators continue to "make their mark in the world" in the wrong way and for the last time! ELMER G. STILL.

Livermore, Cal.

Science and Education in the Future

To the Editor of the SCIENTIFIC AMERICAN:

Allow me to note my appreciation of your editorial in the issue of November 22nd "Science and Education of the Future."

The idea for the consideration of those who follow science that the needs of men are not purely material is particularly commendable. Until science shall deal with those problems affecting the moral status of society as a whole, arising through those workings of natural law as applied to the manner in which men should live in relation with each other, those inexplicable conditions causing poverty in the midst of plenty will manifest themselves.

There is more poverty in stunted minds than in empty stomachs. Men are after material things only while the fear of poverty persists. Relieve them of this fear and the desire for better things appears. Science *can* solve the matter of right living by applying to the question what is intended by natural law should be. All science is based on physical conditions as the first man found them. Is natural law so weak a thing that there is no application of it possible to what most concerns humanity? Bacon said that "we can command nature only by obeying her." Our social state teems with errors that will not stand the test of true science. We are artificial instead of natural in our manner of living together. *There are laws* governing wages, rent and interest; and the laws when fully comprehended will be found to determine that equitable distribution of the products of land, labor, and capital so necessary to produce in society that which will go to make up a harmonious whole and conduce to the moral uplifting of the race.

The church has had this matter in hand too long; and has almost utterly failed. Science should assume its proper function and take hold with all the intelligence at its command, and if nothing is taken for granted but what will stand the test, science will succeed.

Callaway, Neb. FRANK L. HAYCOCK.

Humane Animal Trap

To the Editor of the SCIENTIFIC AMERICAN:

I desire to thank you for the space accorded my appeal for the invention of a humane animal trap to take the place of the cruel, torturing steel trap that causes such agony (for hours and even days) to the hapless foxes and other animals that are caught in its iron teeth, until the trapper comes along to "empty" the traps.

The several letters published since mine appeared show that the suggestion was thoughtfully received, but the communication from Mr. Magrath in your issue of October 25th, suggesting that one of the humane societies offer a prize of $500 through the SCIENTIFIC AMERICAN, for a practical humane trap that would put the animal painlessly to death without first torturing it, is the best that has appeared, and I heartily and strongly indorse that writer's most excellent suggestion and trust that those most interested will make the prize offer a positive fact, or perhaps some humane reader of the SCIENTIFIC AMERICAN would be willing to offer the $500 prize out of his own pocket.

If I were a man of wealth I should not invite some one else to perform a duty that I (as a friend of animals) considered belonged to me, but unfortunately I am not a Henry Bergh. I am deeply grateful, however, to the SCIENTIFIC AMERICAN for what it has done in the matter. GEORGE FOSTER HOWELL.

Brooklyn, N. Y.

Kites for Carrying Lifelines

To the Editor of the SCIENTIFIC AMERICAN:

The convention for the furtherance of safety at sea, which is about to be or is being held in London, brings to my mind an idea which has haunted me for many years.

Every time this idea has presented itself I have put it aside on the ground that it was so obvious, that it must have occurred to many minds more conversant than mine with the subject in question, and by them rejected as impractical. Yet, on the other hand, I have never been able to detect any serious flaws to my scheme. To come to the point: Why are not all ships equipped with kites capable of taking a lifeline ashore? It would seem to me that about 99 per cent of all shipwrecks are off a shore, and in most cases happen while a strong wind is blowing. Kites are made to-day on scientific principles with very great steadiness and much lifting power. I fail to see why a kite should not be able to carry ashore to leeward as large a cord as can be shot from a gun to someone, and with greater surety and over a greater distance. The shore is a large mark and the ship a small one.

Of course I have not marked out the details. Whether the kite should be "box" or otherwise; whether it should carry the cord as a tail or be equipped with a tripping device to cause it to collapse at the proper moment; these are questions to be decided by experiment, but which would appear to present trifling mechanical difficulties.

Kites are cheap and they are easily stowed.

Indian Mill, South Natick, Mass. JOHN BOIT.

A Suggestion for Life Saving

To the Editor of the SCIENTIFIC AMERICAN:

I beg respectfully to lay before you an idea which has suggested itself to me in connection with saving life at sea in that particular condition which prevents the use of boats owing to terrific seas.

I base my idea on the assumption that the man-lifting kite as used occasionally in military work for observation purposes is a practical idea. I propose that the vessel which is rendering help should on approaching the sinking or disabled vessel run out a man-lifting kite. She would maneuver to windward so as to bring the line over the distressed vessel. Then following the idea which boys make use of in sending a "message" along the line, an endless trailing light rope would be dispatched. This would run one pulley with a wind sheet attached. The gale, or strong wind, would send this along, and as the trailer passed over the ship in distress it would be seized. The line could now be hauled down to the deck of the distressed ship and a breeches buoy with pulley could be placed in position on the main line. Then when everything was ready the trailing line would be eased out and the pull of the main line would lift the breeches buoy with its human freight into mid-air. As soon as it reached a certain altitude a releasing device would allow it to run toward the rescue ship. Gravity effects this, the pulley and breeches buoy running down the inclined plane. Rescue in a gale of wind and mountainous seas could thus be effected, while the use of boats is out of the question.

The declivity of the inclined plane represented by the line could be regulated by the trailing rope. On easing the trailing rope out, the main kite line would rise; on hauling it in, the kite line would be brought lower. In this way the inclined plane between the two ships could be controlled and the speed of the breeches buoy and its freight governed.

I have not patented the idea, preferring to place it before the SCIENTIFIC AMERICAN.

If you think there is a possibility of the idea being developed, you are welcome to make use of my suggestion. R. MACDONALD.

Leicestershire Club, Leicester, England.

Studying Ripening Bananas With the Respiration Calorimeter

MESSRS. C. F. LANGWORTHY and R. D. Milner of the Department of Agriculture, have published in a special bulletin, some results obtained in studying ripening bananas with the respiration calorimeter.

A consideration of the available experimental and other data obtained shows that the successful handling of fruit during transportation, in the cold-storage warehouse, and in the home depends upon a knowledge of the changes which take place in ripening, after ripening, and decay, and the causes of these changes and ways in which they may be controlled. Present practice is based on knowledge gained by experience, supplemented by work carried on in the laboratory.

The respiration calorimeter offers a new means for studying fruit-ripening problems. The results with bananas during the active ripening period show that the ripening changes progress regularly to a maximum and then decline; that at its greatest intensity the heat produced is equivalent to approximately one calorie per hour per kilogramme of bananas. The heat liberated is a measure of the activity of one or more of the ripening processes. Analysis has shown that during ripening the banana starch is transformed into cane sugar and the cane sugar into invert sugar, and that there are important changes in the character of the tannin compounds, and that other changes occur, brought about by the production of aroma and flavor bodies, and perhaps in other ways. It has also been found that in addition to the transformation of carbohydrates there is an actual loss of this food constituent during ripening. From the data for oxygen consumption, carbon dioxide, and heat output it appears that the heat liberated by the ripening bananas is due largely to the destruction of carbohydrate. The results recorded and discussed represent only a part of the material which is being accumulated. No attempt is made to draw deductions regarding the practical applications which can be made, as this may be done more properly when experiments now under way are completed.

Sixteen Miles of Rough Sea in a Canoe

MR. A. G. HEBGEN of San Francisco, Cal., has just completed a most remarkable trip in a motor driven canoe. Although the sea was very rough, Mr. Hebgen started out for a trip from Belvedere to Alameda, Cal. His objective point at Alameda was the Encinal Boat Club House, sixteen miles from Belvedere. His canoe was equipped with a rowboat motor, and in spite of the waves and general rough weather which he encountered during the entire sixteen-mile trip he made the trip in a few minutes over one hour, maintaining an average speed in his motor-driven canoe of thirteen miles and forty-six yards per hour. This is one of the few instances when a very severe trial has been given to the motor, and it is interesting to note that, in spite of conditions which were not of the best, Mr. Hebgen maintained an even speed from the time he left Belvedere until he reached his objective point many miles away. When Mr. Hebgen passed over the waters of the bay he crossed Raccoon Strait on his way around Yerba Buena Island.

Atlantic Steamships—A Retrospect

Thirteen Years' Development of the Transatlantic Liner

By J. Bernard Walker

IN the autumn of the year 1900, that is to say, just 13 years ago, the SCIENTIFIC AMERICAN published an article dealing with the question of the possible increase in size and speed of the fast transatlantic liner. That was the year when the old "Deutschland," now the reconstructed "Victoria Luise" of the Hamburg-American Line, reigned supreme upon the Atlantic, having captured the so-called "blue ribbon" by covering the course from Sandy Hook lightship to the coast of Ireland at an average speed of 23.3 knots. In the years immediately preceding, the transatlantic record had been raised from the 22 knots of the "Lucania" to the 22.5 knots of the "Kaiser Wilhelm der Grosse," from which ship the record was taken in 1900 by the "Deutschland" in a famous over-sea race between the two ships, in which the writer was so fortunate as to be a passenger on the winning ship. So-called races on the Atlantic Ocean exist only in the imagination of the passengers; but in this case the owners, stung by the assertion of the rival line that the "Deutschland" could not have made 23 knots on her maiden trip, deliberately started the ship just one hour later than the "Kaiser Wilhelm der Grosse," which was overtaken and passed about noon of the following day, and the superiority of speed of about one knot of the new ship thereby established beyond question. The enthusiasm aroused by the speed of the "Deutschland" led to the frequent assertion in the public press that the time of the four-day, thirty-knot boat was approaching and that such a ship might confidently be looked for in the port of New York within the next few years.

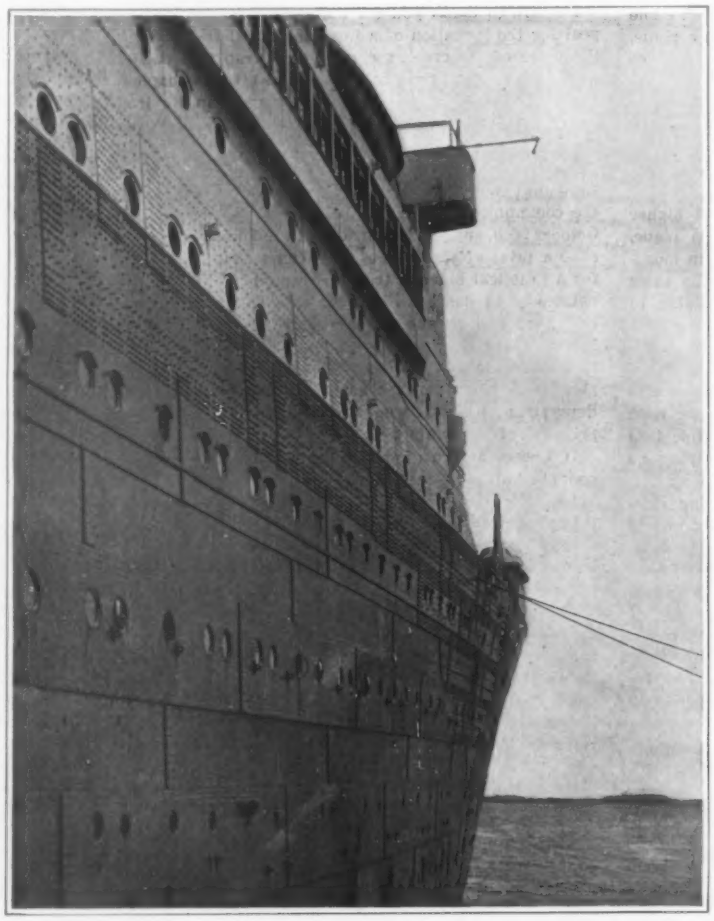
With a view to making an approximate estimate of the dimensions and horse-power which would be necessary to enable a ship of the "Deutschland" type to cross the Atlantic at an average speed of 30 knots, the writer made some rough calculations and embodied the results in a drawing, published in our issue of November 10th, 1900, which is herewith reproduced. It was disclosed that a four-day, thirty-knot vessel, equipped with motive power consisting of Scotch boilers and reciprocating engines, and built within the limits of draught of thirty feet imposed by the German harbors of that day, would have to be 930 feet long and 87 feet broad; that it would displace 40,000 tons; and that the horse-power required would be 110,000.

In view of the fact that during the intervening years, since the article was written, the daring suggestions as to growth in size and speed have been surpassed, the former by the "Imperator" and the "Vaterland," and the latter by at least one of the large British battle-cruisers, we republish on the accompanying page the original drawings and make the following quotation from the text of the article, as published in 1900:

"FOUR-DAY LINER.—As to the possibilities of the future, it is evident that with our present form of hull and type of motive power, we have nearly reached the limit of economical speed. To drive the 'Deutschland' at 30 knots would require about 83,000 horse-power, two and a quarter times as much as she now possesses. The accompanying diagram proves that if Scotch boilers and slow-revolving engines were provided in the design of a 30-knot 'Deutschland,' it would be impossible to put into her shell more than one half of the necessary amount of power. Evidently to secure 30 knots a larger boat would be required, and a larger boat means increased power to drive the increased weight. The increase in power, however, would not be directly proportional to the increase in the displacement, the longer ship being ton for ton easier to drive, because of the refinement of her lines due to her greater length. Nevertheless, by the time we have designed a boat large enough to carry the power corresponding to a speed of 30 knots, we shall have upon paper the mammoth ship represented in our drawings. She will be 930 feet over all, 87 feet in beam, and 30 feet in draught, and will displace about 40,000 tons. Engines of 110,000 horse-power would be required, and even if triple screws were used, it would be necessary to develop 37,000 horse-power on each shaft—a task that would stagger the best of the world's engine builders of to-day. Forty-four double-ended Scotch boilers would be required to supply the steam, and during each day's run of twenty-four hours 1,710 tons of coal costing $7,700 would have to be fed into the 352 furnaces. It would require 7,300 tons of coal to carry the vessel to Plymouth and 8,550 tons to take her to Hamburg, the cost of the fuel alone being $36,000. The ship would have to stow 9,550 tons of coal in her bunkers for a single trip across the Atlantic.

"To anyone who has watched the reverse bending strains to which a ship like the 'Deutschland' is subjected when she is being driven across the Atlantic seas, it is evident that we have come to a point where it will be necessary to give increased longitudinal strength to any vessel that exceeds the present length of 700 feet. In a four-day liner this might be provided for by running a longitudinal stiffened bulkhead, extending from the keel to the promenade deck, through the vessel between the after engine-room and the forward boiler-room bulkhead. The vessel might be further strengthened by carrying up the side plating to the promenade deck, which is placed one deck higher than in the 'Deutschland,' and by doubling the plating at the bilges and at the promenade deck, as shown in the midship section of the ship.

"In conclusion, it is safe to say that such a vessel as this will never be built. We shall cross the Atlantic in four days, but not with a vessel of this type. The higher speed will be attained, not by multiplying engine and boiler weights, but rather by multiplying pressures and engine speed, and utilizing every refinement in the way of economizers, superheaters and feed-water heaters, as is being done by Mr. Mosher in his 40-knot craft, the 'Arrow,' described in our last issue of the SUPPLEMENT. If a 30-knot transatlantic steamer makes its appearance within the next few years, it is safe to say that it will be driven by the combination of water-tube boilers, using hot, forced draft, with fast-running reciprocating engines, using superheated steam, or with turbines of the Parsons type. So great will be the reduction of weights and saving of space achieved by this change, that it will be quite within the possibilities to produce on a displacement not much greater than that of the 'Deutschland' a 30-knot ocean steamer that shall have equal accommodations for passengers."



The bow of this ship (the "Imperator") reaches 56 feet above the sea; the captain's bridge is 75 feet above the same level.

The towering topsides of a modern liner.

It is interesting to note, after the lapse of thirteen years, to what extent the prediction of 1900 has been fulfilled in 1913. In the first place we find that, in order to give the proper girder strength, the doubling of the plating has been incorporated in the present-day ships of 800 to 900 feet length. The "Mauretania" has three-fold plating 3 inches in aggregate thickness for some 300 feet amidships, a special steel of high tensile strength being used. The "Imperator" has double plating, and in both of these ships the girder strength is further assured by constructing the main and other upper decks of steel and by a great increase in the plated depth of the ship. The "Mauretania" is plated to a depth of sixty-one feet, and the "Imperator" to a depth of seventy-three and one half feet. The association of steel decks and doubled plating with great depth of ship makes it unnecessary to use the central longitudinal bulkhead which would have been necessary in our four-day boat with its relatively shallow plated depth of about fifty-two feet.

More striking, even, than the increase in length is the great height to which the structure of the modern liner has reached—a fact which is clearly shown in the shadow picture at the bottom of the accompanying page, in which it will be seen that the topmost deck of the "Imperator" is level with the tops of the smokestacks of the "Deutschland." The "Imperator" has no less than eight decks above the waterline, as against four in the "Deutschland." From keel to roof of the topmost structure she measures over one hundred feet. Such accommodations would have been impossible in our four-day liner, with its refined model, moderate beam, and limited draught of 29 to 30 feet, necessitated by the shallower harbors of that day. But the "Imperator," on a draught of 37 feet and a beam of 98 feet, has ample stability to carry her towering superstructures. In 1900 the steam turbine was yet, in so far as ocean steamers were concerned, in the experimental stage; and, as we showed at the time, the three triple-expansion engines for a four-day "Deutschland" would have reached a size for each unit of 37,000 horse-power. We question whether the steel makers of that or of this day, for that matter, would have cared to guarantee hollow-forged shafting to carry safely a load of this magnitude.

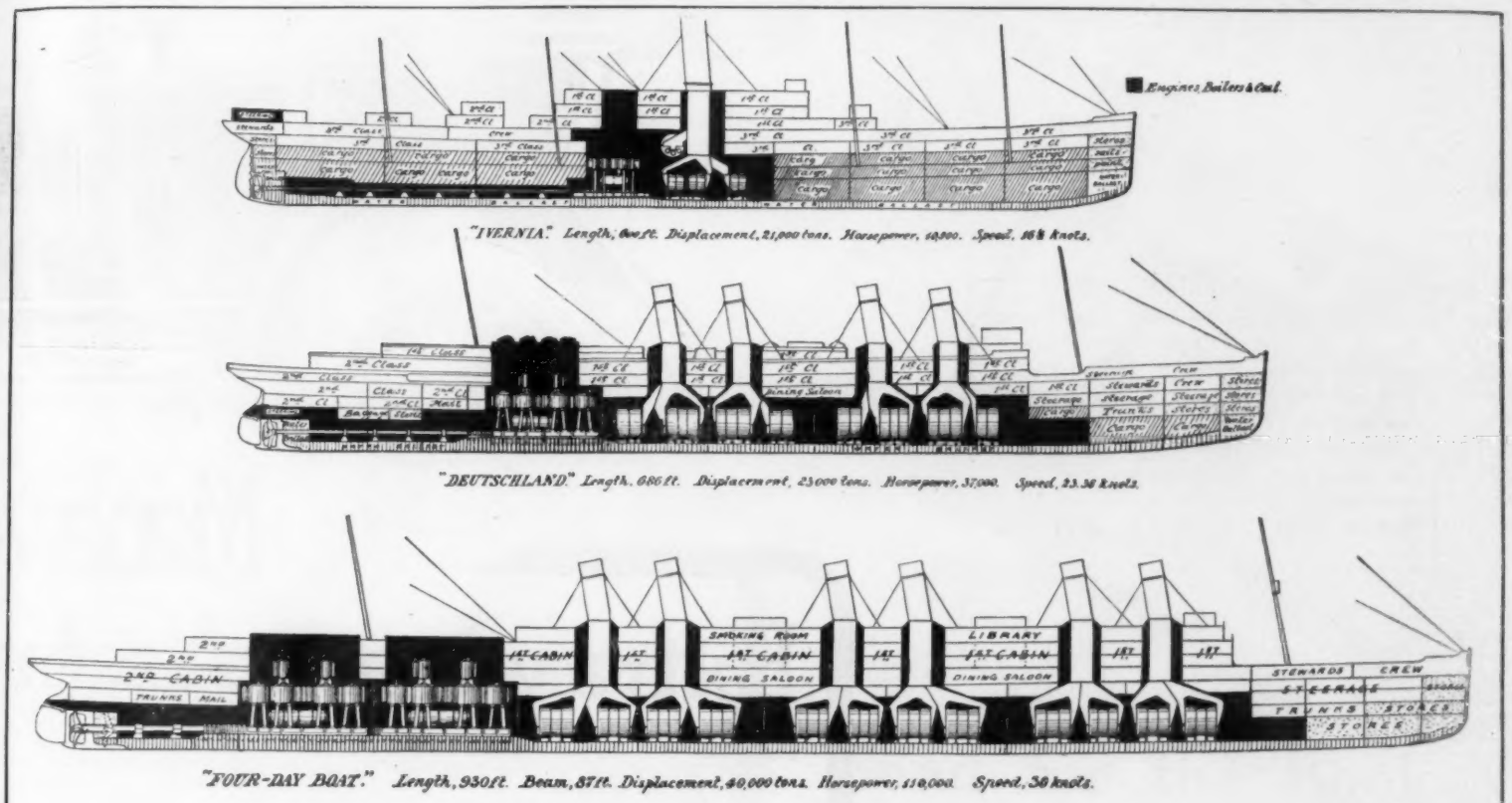
The first notable step toward the 30-knot limit was

	Displacement in Tons.	Horse-power.	Speed in Knots.	First Cost.	Coal Burned per Day, Tons.	Bunker Capacity, Tons.	Cargo Capacity, Tons.	Passengers.				Crew.	Estimated Maximum Receipts for Full Ship, One Passage, Exclusive of Mails.
								First.	Second.	Third.	Steerage.		
"Ivernia".....	21,000	10,500	16.50	$1 625,000	150	1,250	11,610	160	200	none	1,600	250	$50,000
"Deutschland"..	23,000	37,000	23.36	3 300,000	572	4,500	600	450	300	none	300	550	143,000
Four-day liner..	40,000	110,000	30.00	6,200,000	1,710	9,850	none	800	450	none	250	950	225,000
"Imperator"....	58,000	62,000	23.00	8,500,000	1,000	9,200	500	800	600	900	1,700	1,200	300,000

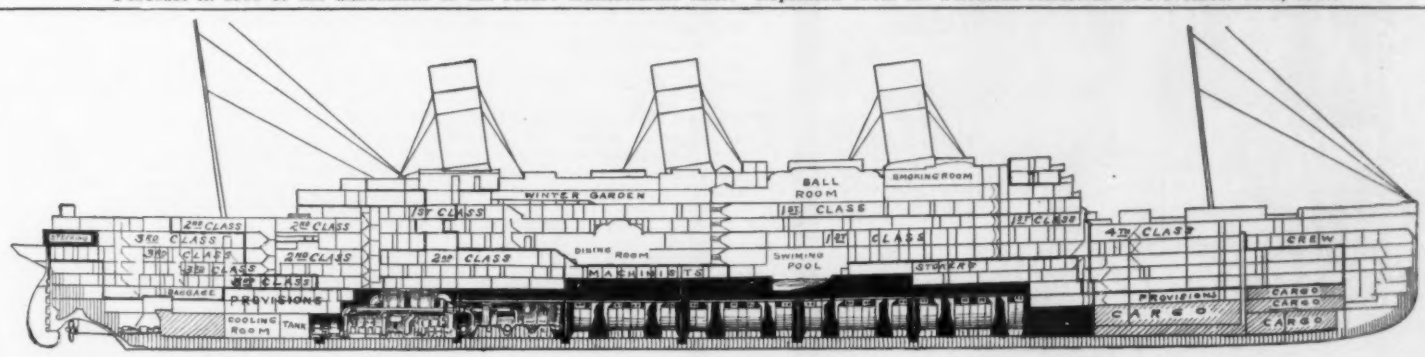
taken when the Cunard Company placed in the "Lusitania" and "Mauretania" turbines of 68,000 horse-power, with which, in the "Mauretania," they secured a trial speed of 27 knots for several hundred miles, and later had the satisfaction of seeing that fine ship cross the Atlantic at an average speed of 26.01 knots for the whole trip. It is a far cry, however, from 26 knots to 30 knots, if we remember that the necessary engine power mounts up approximately as the cube of the speed; nevertheless, the fact that one of the British battle-cruisers, a ship of nearly 30,000 tons full-load displacement, has made over 30 knots for many hours, renders it certain that, if any transatlantic company cared to make the sacrifice in carrying capacity which would be necessary, it would be possible, with the use of reduction gears, to design a turbine-driven ship of large size that would make the passage in four days.

As matters now stand, the "Imperator" represents the best all-round combination for securing fair speed, great seaworthiness, absolute reliability as to the time of passage, and a reasonable return on the investment, that can be devised. When, in the course of the design of this ship, the question of speed came up, an investigation was made as to what sacrifices would be necessary if the speed were raised from 23 to 26 knots, and it was found that at least two of the upper decks would have to be sacrificed; that the hull would have to be fined out until the displacement and therefore the carrying capacity had been greatly reduced, and that

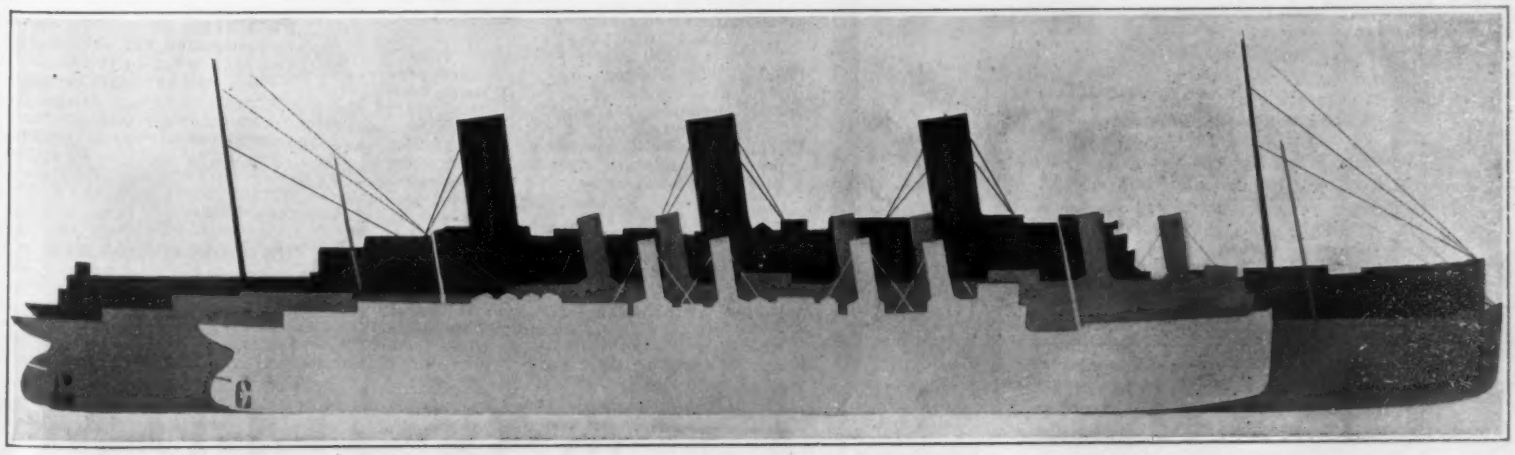
(Concluded on page 481.)



Forecast in 1900 of the dimensions of the future transatlantic liner. Reprinted from the Scientific American of November 10th, 1900.



"Imperator," 1913. Length, 909 feet. Beam, 98 feet. Displacement, 58,000 tons. Horse-power, 62,000. Speed, 23 knots.



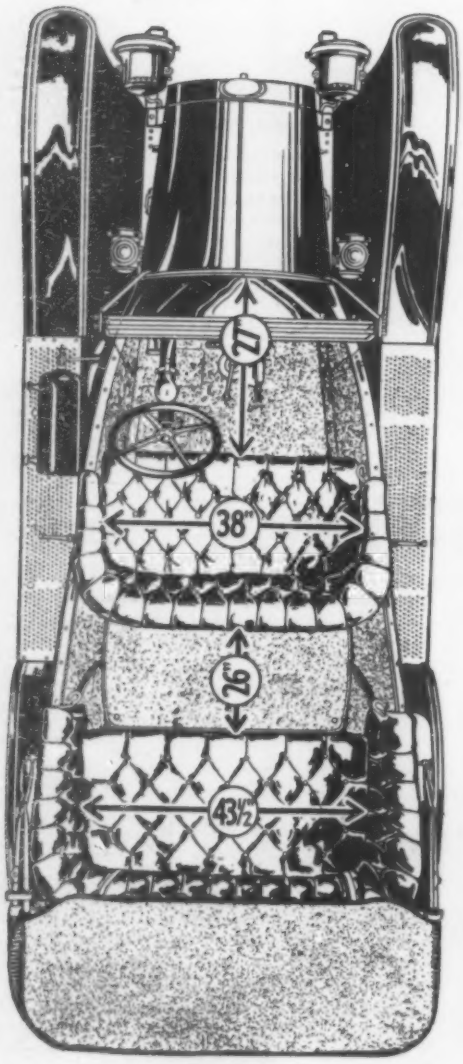
The "Deutschland," 1900 (light shade); a 30-knot "Deutschland" (medium shade); and the "Imperator" (black) drawn to common scale.

ATLANTIC STEAMSHIPS PAST AND PRESENT

Here is the "Biggest" Au

CHECK the measurements — leg room, depth and width of seats—with those of any car selling from $1000 up to $1400 —you'll find this is a "big" car in inches as well as "immense" in efficiency. Note up-to-date stream-line body design, left-hand steer, center control and other features of the highest-priced cars.

SEND FOR THE BOOK



Maxwell 25

Extravagant Assertion

WHO WAS the "biggest" general in the world? Napoleon, he conquered Europe—and he was five-feet-three!

WHO WAS the "biggest" statesman in the world? Bismarck, he built the German Empire—and he was six-feet-four!

SO YOU SEE MERE SIZE DOESN'T determine who nor what is biggest. It is achievement that confers that title "biggest."

WE MAINTAIN that the biggest automobile in the world is the one that does the biggest things—and does bigger things than a bigger car can do at the same cost.

AND THAT CONFERS THE TITLE on the Maxwell "25," which sells for $750, and which, though of ample capacity for carrying five full grown adults anywhere any car will go, yet weighs only 1,650 pounds.

THIS CAR CANNOT BE CALLED either small or large—in inches. It is neither a Napoleon nor a Bismarck in physical proportions—but is a combination of both in efficiency and—in competition.

IT IS THE MOST FORMIDABLE rival other cars have ever encountered.

ITS CONQUESTS have embraced the territory formerly held by both the very cheap, and the overly-large, underly-efficient cars, selling for $1000 and more.

IT CONQUERS because it meets the needs and the ideas of the majority of informed buyers. It appeals at the same time to the logic of common sense and the sense of the beautiful.

ITS BEAUTY is shown in looks and in performance—handsome is as handsome does—and handsome as is.

THE BUYER WHO must take a peep into the purse before buying, here finds a car within his reach and made to his heart's desire.

ON THE OTHER HAND, the buyer who is easily able to pay the first cost, but whose experience has taught him to look still more closely into maintenance cost afterward, finds in this 1,650-pound, five-passenger car the one he has been looking for—because it will do all any 2,600-pound car will do—and more—and at half the upkeep cost—or less.

COST OF UPKEEP increases as the square of the weight, the tire makers tell us. And Standard Oil dividends confirm the statement.

CUT THE WEIGHT IN TWO and you divide the upkeep cost by four! Get that—it's the kernel.

BUT WE'RE A NATION of aristocrats—no matter how we protest we're democratic, we are aristocrats. Every American deems himself of the Royal line. We have pride, plus—more per capita than any other people in the world.

AND SO IT HAPPENS that your American demands more than mere utility in the car he buys—he wants style as well as size.

A FEW YEARS AGO a lot of misguided persons had a brilliant idea. They maintained that the "farmers' car" had not yet been built.

WHEN ASKED TO SPECIFY, they said the farmer's car should look like a farm wagon or a dump cart—or some other familiar vehicle.

SO THEY MADE A FEW of those ridiculous, high-wheeled, air-cooled "putt-putters," and gleefully invited the farmer to come and see.

FARMERS DIDN'T COME—they were too busy inspecting the latest improvements in real automobiles. So the high-wheeler soon went out of business.

THAT PROMPTED US one day to make a little investigation and to compile a few statistics—and what do you think?—

WE FOUND that, contrary to the prevalent supposition—the best markets for second-hand cars were not what the blase call the "backwoods and the prairies," but Broadway and 42nd, New York; and Michigan Avenue, north of 30th and south of Congress, Chicago!

"ALL THE RUBES LIVE ON MANHATTAN," once said a famous showman. That was more than half true—the other 49 per cent are portioned out to Chicago and other large centers. There live the Fourflushers, the Johnny-speeders and the remittance boys.

MAXWELL MOTO

(INCORPORATED) DETROIT MI

Automobile in the World

ell 25/4 $750

tion?—Let's Analyze It

TO GET RID OF THE FREAKS—the experiments, the unfit—there is your market. But to the up-to-date farmers of the East, West and South you cannot sell any but the latest model, made by a responsible concern—nor to the business men living outside the cabaret zones of the big cities.

AND SO in designing this car we set as our standard a car not only of the highest utility, efficiency and economy, but of style and beauty as well. Because this car must appeal to those who know—business men and successful farmers—who have pride plus—and are entitled to it.

SEVEN HUNDRED AND FIFTY DOLLARS is a lot of money to a lot of people—and we designed this car to meet the needs and demands of a lot of people.

WE HAVE TO MAKE A LOT of them, to make them at all, at the price.

THOSE PEOPLE HAVE A RIGHT TO EXPECT, in the car they buy, something of which they may be proud, as well as one that will perform the service.

THAT WAS NO EASY TASK. In fact, it was—it had proven to be—an impossible task to other makers, other designers.

JUST CONSIDER FOR A MOMENT. It's child's play to design and make a $5000 car. Mechanically the latter presents no problems at all—for the engineer can use any material and as many pounds as he pleases to achieve his results—the buyer of such a car will not only pay the price but pay the "freight" also—the tire and other maintenance bills.

THAT'S CHILD'S PLAY as compared with the task set our engineers and metallurgists—to design a touring car of ample capacity to take five full grown adults anywhere, over any roads, in comfort;

SO STRONG it will withstand the usage and neglect such a car receives at the hands of the average owner who drives—but hasn't time or inclination to care for it—himself;

SO LIGHT that the tire bills and the maintenance cost will, like the purchase price, be within the reach of that "lot" of people who insist an automobile should be an economy, not an extravagance;

AND FINALLY, of external design to conform to the current mode of "streamline body," and finished and upholstered so that the wife and daughters will be just as proud of the appearance as the owner is of its performance.

THERE WAS A TASK to test the skill and the experience and knowledge of the best corps of engineers, and the learning of the best metallurgists known to this industry.

AND THIS $750 MAXWELL IS THE RESULT.

HAS IT OCCURRED TO YOU that in the entire history of this industry this is the first time that feat has been accomplished? Well, it is.

AND WE CONTEND it is still impossible to any other concern—any other organization.

WE WERE PECULIARLY SITUATED—ideally equipped to do it. Had no old models to get rid of—none with which this would compete. We had the plants, the capital, the talent and—the experience. You can't beat that combination.

NOW, READ THIS—it's what you are most vitally interested in—deliveries.

WE ARE MAKING 50 CARS PER DAY of this model. That isn't a circumstance, of course. Demand is for five times as many even at this season. Spring demand—we don't dare contemplate.

OUR PLANTS ARE BIG ENOUGH to make 300 per day—and that is what we are preparing for. But special machinery can't be made over night nor produced by necromancy. So we can't hope to reach a production of more than 200 per day before February at earliest.

SO YOUR MOVE IS—to see the car at once—your nearest dealer. Have a thorough demonstration. Talk to your acquaintance who has been fortunate enough to get one. He'll say more than our modesty permits—more than you'd credit from an over-enthusiastic maker.

THEN DON'T DELAY—get your order in. Pay a deposit to guarantee delivery and to assure it at a time when others will be offering premiums. Then you'll be able to rest easy in the knowledge that you've secured the greatest automobile value ever known.

TOR COMPANY

DETROIT MICHIGAN

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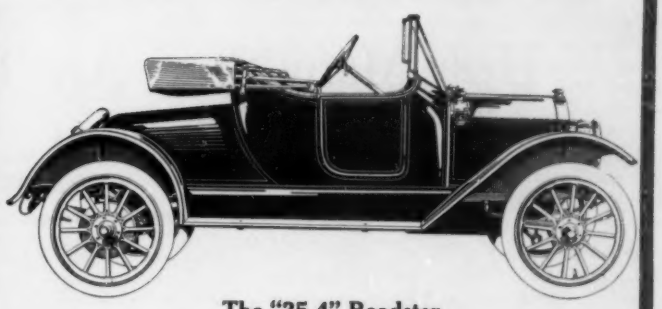
Also (free) our booklet "How To Make Your Car Live Twice As Long." Read It—it's worth dollars to you. Address Department "W."



The "25-4" Roadster

A natty, classy, speedy two-passenger car that will go anywhere any car will go—and faster. Same chassis specifications as the touring car (Send for the Book). Price $725, fully equipped.

MAXWELL MOTOR COMPANY,
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Dear Sirs:—

I would like to know more about "The 'BIGGEST' AUTOMOBILE IN THE WORLD."

Will you kindly mail the book and booklet "How to Make Your Car Live Twice as Long."

TO.....

P. O.....

R. F. D. No..... STATE.....

The region of Messier II. seems literally powdered with stars. It is hard to believe that these white dots are all stars, many of them brighter, hotter and bigger than our sun.

How Many Stars Are There in the Milky Way?

A Great Astronomical Problem and How It Is Attacked

By John W. N. Sullivan

Illustrated With Photographs Made at the Yerkes Observatory

ON a clear moonless night, if the sky be attentively observed, a dim, broad, irregular patch of light may be seen, sweeping right across the heavens from horizon to horizon. This long and faintly luminous cloud is known as the Milky Way, and it does in truth make a complete circuit of the heavens. If observation is assisted by a powerful telescope this band of luminous haze is seen to consist of a countless multitude of stars.

It would seem that any attempt to calculate the properties of a system of such exceeding complexity must be fore-doomed to failure. Nevertheless, it is possible, by mathematical reasoning, to reach certain conclusions respecting the constitution of this object which are of the highest interest and importance. The mathematical methods necessary for such an undertaking have been developed by Maxwell, in connection with his researches on the theory of gases. A gas is regarded as made up of an immense number of very small particles, moving about in various directions and with various velocities. These small particles act on one another at a distance, but in such a manner that at a distance large compared with their own dimensions, their mutual action is inappreciable. But if two such particles come sufficiently close together, they perturb each other's motion, and the result is a different distribution of velocity. The fact that the particles are present in enormous numbers and that their motions are random ones, renders the application of the theory of probabilities possible, and on this basis many of the characteristic properties of gases have been satisfactorily explained.

Lord Kelvin, by a bold imaginative leap, jumped from the consideration of a gas to the Milky Way. There also we have an immense number of bodies moving at random, perturbing one another's motions at short distances and exerting no appreciable effect at large ones. To the mind of some super-human being, to whom the stars of the heavens appear as molecules do to us, the Milky Way is but a gas, free in space. The statistical methods of calculation introduced by Maxwell may be used in this case also. Among other things, we are in a position to calculate the dimensions of the Milky Way, from observations on the velocities of the stars nearest to us.

If a gas were removed from its containing vessel and left free in space, it would, under the action of the mutual attraction of its particles, assume the form of a sphere. At the center of such a sphere the pressure, and in consequence the temperature, will be greater, the greater the sphere, since the pressure at the center is increased by the weight of all the surrounding layers. We have good reason for supposing that our solar system is situated near the center of the Milky Way, and hence, from observations made on the velocities of adjacent stars we can determine the temperature corresponding to our position, and hence calculate the radius of the sphere. As a result we find that the radius of the Milky Way, considered as distributed in the form of a sphere, is about one thousand times the distance of the nearest stars, which leads to the result that there are about one thousand million stars in the Milky Way. This calculation is only approximate and is not affected in order of magnitude by the fact that the Milky Way is not a sphere, and that the kinetic theory of gases is not compatible with the hypothesis of a homogeneous sphere.

This theoretical result, that there are one billion stars in the Milky Way, is the same as has been reached by telescopic observation, a fact which is distinctly surprising. For the theoretical result gives the *total* number of stars present, while telescopic observation can only give the number of bright stars present. From the concordance of the two results it would appear either that there are no dark stars in the Milky Way, or that their number is altogether inappreciable in comparison with the bright stars. We shall see that this result is rather disconcerting when considering the age of the Milky Way.

In regarding the Milky Way as a gas we have not been sufficiently precise in our conceptions. Everybody is now familiar with the fact that Crookes discovered the existence of a fourth state of matter; matter which is neither solid nor liquid nor gaseous, and which has been named radiant matter. The difference between radiant matter and a gas is quite easy to grasp. If in a vessel containing particles of matter in motion the chances are that a particle, in traversing the vessel, will experience one or more collisions with other particles, then such an assemblage of particles is called a gas. If it be possible for the particle to traverse the vessel without collision, the matter is said to be radiant, so that an assemblage of particles which in one vessel is a gas may, in a smaller vessel, be in the radiant state. Now if the sphere of influence of each star in the Milky Way be regarded as being as large as a sphere inclosing the orbit of the planet Neptune, then all these spheres, distributed over the celestial sphere, would only cover one sixteen-thousandth part of it. It is apparent, therefore, that it would be quite possible for a star to pass through the Milky Way without experiencing a single collision. So that the Milky Way is not so much analogous to a gas as to matter in the radiant state. However, the results we have formerly

obtained are but little modified by this consideration.

It was for some time thought that the Milky Way is distributed in the form of a disk, the Solar System being placed near the center of this disk. This view was first advanced by Thomas Wright, an instrument maker in London, in a book published in 1750. He imagined a big grindstone made of glass, in which were embedded a number of grains of sand. If now these grains be observed from near the center of the grindstone it is evident that near the axle we should see but few grains, but that toward the circumference the grains would seem to cluster more thickly. But this view, ingenious as it is, is beset with too many difficulties to render it longer tenable.

The most promising view at the present day is that which regards the Milky Way as a spiral nebula. If we examine the heavens through a powerful telescope, we shall see, in addition to the stars, masses of faintly luminous cloud. Some of them are of irregular outline, such as the great nebula in Orion, but others have a singular spiral conformation. Of the various nebulæ which are known we may distinguish, roughly, two classes: those which are formed of masses of gas, and those which are formed of stars. The spiral nebulæ belong to the latter class, and are usually considered to be independent of the Milky Way. If they are systems of the same size their distance from us must be about one thousand times the radius of the Milky Way itself. It is only necessary to cast a glance upon one of these singular objects to see that it is in rotation. It is even possible to see what is the direction of the rotation, since all the arms which extend from the central mass are curved in the same direction. Mathematical considerations further lead us to see that there must be internal currents in these masses of stars. The members of the system are either moving out from the center or moving toward it, and the whole mass is in a state of rotation. After a time the effect of these various actions will be to bestow on the system a configuration of relative equilibrium, a figure which it could preserve unchanged for an enormous period of time, although not indefinitely. And the present configuration could have been reached only as the result of an enormous number of collisions. With the results we have reached before, respecting the density of the Milky Way, we are in a position to estimate the time taken to assume its present form. And here we are faced by a difficulty. From quite other considerations it has been estimated that the stars can have but an ephemeral existence—a matter of some fifty million years. This is altogether too short a time to allow the system to reach its present state. Are we to suppose that the Milky Way started to form while the bodies composing it were yet dark? And if so, are we further to suppose that they all became visible at about the same time? This seems a very unlikely supposition. But if not, we are to assume that a considerable part of the Milky Way is now dark—that the bright stars constitute but a small fraction of the total number. This is where we encounter the difficulty referred to above. We have seen that the estimated total number of the stars agrees with the number of observed stars. There is no indication of the existence, in considerable quantities, of dark stars. We have here two results which it is very hard to reconcile. The reconciliation has not yet been effected. The sketch we have already given may suffice to show the reader that the problem, vast and difficult as it is, may some day prove amenable to the power of mathematical analysis, but for the present we must perforce leave him on a note of interrogation.

The spiral nebula Messier 51 in Canes Venatici. The Milky Way may be such a spiral nebula.

The Blessings of Science on the Battlefield

THE French expert, Dr. Helme, whose decidedly alarming discussion of the wounds inflicted by modern weapons has already appeared in brief in the SCIENTIFIC AMERICAN, returns to the subject in another article in *Le Temps*. Dr. Helme's object in the second of these articles is to show that, if the science of killing and wounding has made great advances in the last two or three generations, the healing art has not lagged behind.

Military surgery, indeed, appears from this statement to have undergone what may fairly be called a revolution since, say, the war of 1870. And the sum total of results in the contest between the agencies of death and the agencies of life is, in regard to recoveries from wounds not instantaneously fatal, that the average number of deaths in 1870 has been reduced by one half. Dr. Helme begins by noting three great changes in the principles upon which those who minister to the wounded in battle must hereafter work. First, there can be no more rescuing of wounded men while actually within the zone of battle. To allow surgeons and stretcher-bearers to move across the line of fire would be to surrender them to certain death, besides assisting the enemy by presenting him with an unerring guide for his artillery fire. Secondly, the fate of the wounded soldier, judging by the most recent wars, may be regarded as settled almost as soon as he is wounded; if the wound be properly dressed at the outset, and thus protected against secondary infection, there will be no cause for anxiety; if not, a fatal issue may be expected. Lastly, the days of rapid, rough-and-ready military surgery—of bullets extracted and limbs amputated on the battlefield—are gone by. Modern surgery, with its audacity of scope and ultra-refinement of methods, demands too great attention to details, too perfect a quiet in its environment, and too much time for operating, to permit of its being practised amid the din of battle.

Dr. Helme is of the opinion, at the same time, that our generation, with its over-stimulated and over-cultivated nervous system, is quite incapable of enduring the pain and nervous shocks through which the *grognards* of Napoleon's armies managed to live.

The actual course of events with the wounded soldier is thus dramatically detailed. With eyes fixed straight in front of him, and filled with the warlike intoxication which eliminates the instinct of self-preservation, the soldier follows the orders of his leaders until he feels himself hit. Then another instinct than the ardor of battle takes possession of his whole being; he now thinks of nothing but finding his way to the wretched company of the stricken, to share his sufferings with them. In this way there are formed on the field of battle what General Troussaint (the surgeon-in-chief of the French army) calls "nests of wounded," to which correspond "nests of assistance." Here the medical students and young doctors have congregated in the midst of the troops, provided with morphine to lull pain, caffeine to stimulate the heart, and serum to repair the tissues wasted by loss of blood. The three great dangers to be met in these early stages of the case are asphyxia, hemorrhage, and infection. Against the last of these three the French soldier is fortified by a little package which he is obliged to carry with him as part of his regular field kit. Within its outer covering of gray linen this package contains another, an impermeable envelop, and inside this again is a provision of aseptic lint covered with fine gauze, besides a large bandage and two safety pins. Outside is a label on which are printed explicit directions for the use of this first-aid (or *pansement individuel*) apparatus. If the soldier is wise and provident, he will have thoroughly mastered these printed instructions long before the necessity for applying them arises; if he is only the average human recruit, and has never looked at them until his hour of anguish arrives, he ought even then to be able to understand their large, heavy type and simple precision of language.

The next thing for the victim to do will be to take advantage of the first lull in the fighting to drag himself to the nearest medical post, or "nest of assistance," which ought to be 1,500 meters (4,921 feet) or 2,000 meters (6,562 feet) to the rear of the firing line. Here his wounds will receive their first scientific dressing with antiseptics. At the same time his case is diagnosed, and a ticket is pinned on to his coat—a red ticket, if he is to be removed to the base hospital; a white one, if he is to be left where he is. In the former case, he will be carried off on a scientifically constructed stretcher (*brancard*), the French type of which is the Eybert, a contrivance so constructed as to be available for transporting the wounded man either in a wagon, on the back of a mule, or on the back of a hospital orderly. For the last of these means of transportation, the *brancard* is strapped, nearly upright, to the forehead, shoulders and hips of the bearer, so that the patient may keep the sitting and slightly prone position desirable in cases of abdominal lesions and known as "Fowler's position."

So much for the routine of gleaning the human harvest while and where the battle still rages. When the turmoil and acute danger have shifted elsewhere, it is possible for the ambulances to make their rounds and pick up the wounded. The modern army ambulance (there are sixteen to every French army corps) is a field hospital on wheels, equipped with facilities for immediate treatment of cases in which delay would entail serious danger. The "field hospital" of thirty years ago is now only a memory. The ambulance, an automobile, takes its load as quickly and with as little jolting as possible to the base hospital, where the veteran surgeons, Red Cross nurses, and all the healing resources of modern science are to be found, amid quiet and orderly conditions almost as favorable to the patient as those of a well conducted hospital in times of peace.

Dr. Helme makes an important point of the increasing usefulness of women in tending the victims of war. "Yesterday," he says, "a young surgeon, lately returned from the Balkans, Prof. René Le Fort of Lille, told me in a voice broken with emotion of his feelings at seeing these benevolent phalanxes of nurses. The societies of Help for the Wounded, the Austrian Cross of Malta, French, Russian, English, German, and Czech women—in the hospitals at Nish, Belgrade, or Sofia you see only these white angels bearing the red cross of redemption." To return to the battlefield, the work of the surgeons and their orderlies does not end with day. At night they have to scour the country and gather in wounded men who have been unable to find their way to any aid station. These nocturnal gleaners of stricken humanity are, of course, provided with lanterns, and in this connection Dr. Helme describes the Gossard-Berthier light, which is specially constructed for the service of the wounded in war. It is an acetylene light, provided with a reflector, which brilliantly illuminates the ground within a radius of 8 meters (26¼ feet), but is quite imperceptible beyond 400 meters (1,312 feet)—a safe distance, considering that hostile armies nowadays never encamp within anything like so short a range.

In this work the traditional friend of man, the dog tribe, also takes part, represented by that German development the *Sanitätshund* and his French version, the *chien sanitaire*. The method of the German *Sanitätshund* is simply to find a wounded man and then bay over

(Concluded on page 481.)

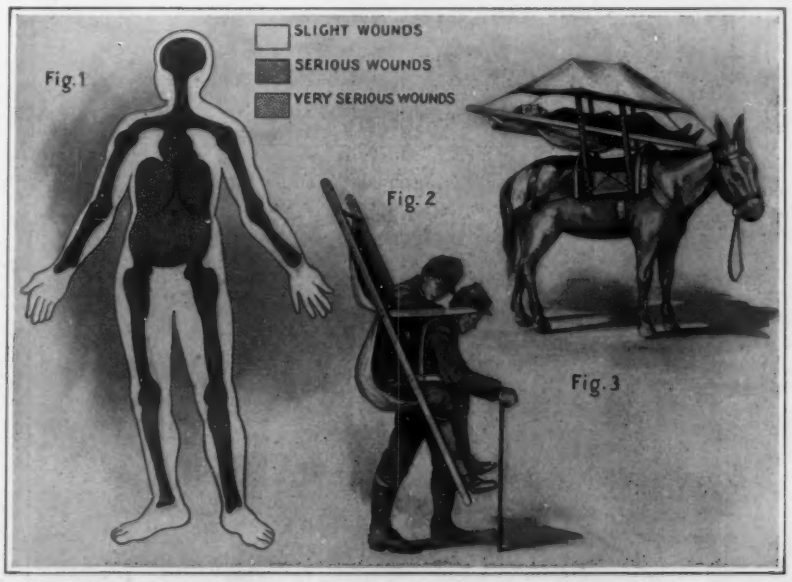
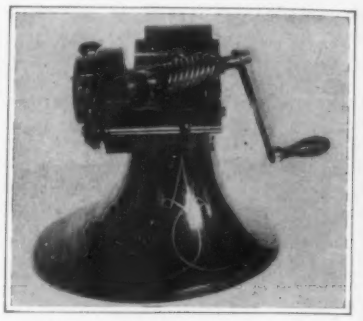


Fig. 1.—The division of wounds according to location shown in the human body. Fig. 2.—Contrivance for transporting wounded man on the back of a hospital orderly. Fig. 3.—Method of carrying the wounded on mule back.

The interior of one of the side-cutter machines.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks



Another interior view of the side-cutter sharpener.

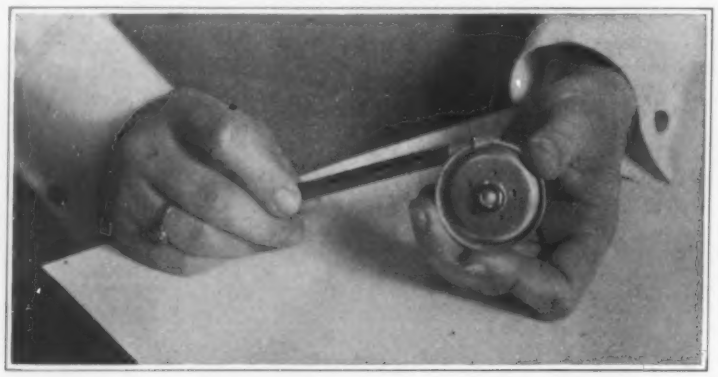
Pencil Sharpeners

A LARGE number of mechanical devices for replacing the penknife in removing the wood and pointing the lead of the ordinary lead pencil have been invented. It takes a keen knife and no little skill to sharpen a lead pencil quickly and without waste, and yet nearly everyone likes to have it neatly treated; hence the legion of "pencil sharpeners," ranging from the little cone-shaped pocket device of boyhood days with a fixed blade for shaving off wood and lead when the sharpener was twisted about on the end of the pencil, to the well-designed machine for serious, continuous business use.

The usefulness of a lead pencil is practically hindered by the fact that not everyone can keep a pencil sharpened, simply because not everyone knows how to handle a penknife. Moreover, cutting the graphite "lead" dulls a good knife blade rapidly. The section of the "paper pencil" (in which a fresh length of lead is exposed by simply slitting the pencil and uncurling a strip of paper) avoids this operation where a sharp point is not necessary. Where many pencils are used, as in schools, offices, telephone exchanges, some quicker and more efficient means of keeping the pencils in good condition than by the hand whittling method becomes imperative.

The ideal device for this purpose should first of all save time, as compared with moderate skill by the primitive method. The auditor of a large railway system, an enthusiastic user of pencil sharpeners for his 120 clerks, somewhat humorously estimates the saving of time on each pencil as 10 minutes, divided as follows: Borrowing neighbor's knife, 2 minutes; sharpen-

In this machine the cutter is at the side of the pencil.

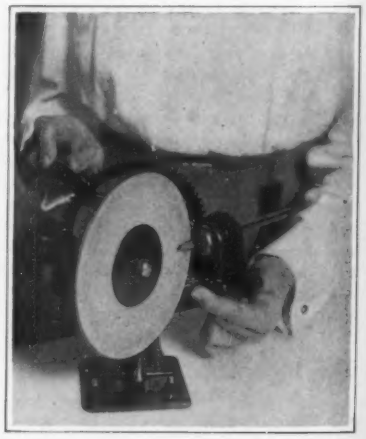


A little device which removes the wood and points the lead by two separate operations.

A pencil sharpener that closely simulates hand whittling.

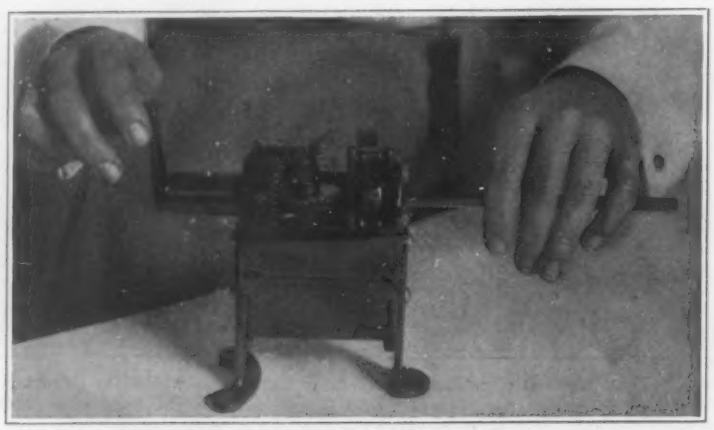
Another representative of the whittling lead pencil sharpener.

Employment of a milling cutter placed at one side of the pencil.



The sandpaper wheel for use in sharpening pencils.

A representative pencil sharpener of the whittling type.



Sharpening a pencil by a pair of cutters revolving around the point while rotating.

A type of clean and efficient whittling lead pencil sharpener.

ing pencil, 3 minutes; washing hands on company's time, 5 minutes.

The ideal pencil sharpener should also be economical of pencils, not only in the actual sharpening work, but in protecting the point from breaking. It should waste less of the lead at each sharpening, and therefore result in long use of the pencil. It should do distinctively neat work while avoiding the dulling of penknives and do away with the litter which using a knife causes. If these requirements are satisfactorily fulfilled the device may still be faulty through its tendency to break the lead. In the hand-whittling method, given a keen penknife, special skill in sharpening a lead pencil is required to point the lead after the wood has been whittled away. The expert human pencil sharpener at this stage cuts very carefully, perhaps supporting the exposed length of the lead on the ball of his finger to ease the chattering pressure of the knife edge. It is safe to say that scheming to deal with this delicate operation has been the main problem in the majority of pencil sharpening devices that have been invented.

In this connection it is noteworthy that many pencil sharpeners which will give good results when new, will break the pencil point by the looseness or side motion of the cutting tool when the bearings of the machine become worn; and the bearings of a pencil sharpener are particularly liable to become worn by fouling with the gritty pencil lead litter in the use of the machine.

In considering some of the representative pencil sharpeners it is interesting to divide them into two broad classes, according to whether the device works by a special method, or like a sort of automaton penknife user. Many machines for use in performing a given work are not imitative of the primitive hand labor operation which they are designed to supersede, but have a new and special way of doing the work. For example, the ordinary sewing machine does not pass a common housewife's needle completely through the fabric on which it is working, but utilizes a special needle, with its eye in the point, which it stabs in and out of the fabric. Just so the majority of the pencil sharpeners which have seen the light of actual use remove the wood and point the lead in a way of their own, and not by an imitation of hard whittling.

Perhaps the majority of pencil sharpeners of both these classes are little machines arranged to be fastened to the wall or to a table and having a crank and gears. One popular type which does the work by a method wholly different from hand whittling has a pair of small beveled milling cutters which while rotating individually revolve as a pair about the pencil, thus cutting away first the wood and later the lead as the pencil is fed through a clamping support in the axis of revolution of the cutters. One object of this design with two cutters bearing against the pencil point from opposite sides is to relieve the exposed length of lead from the side strain which is so liable to break it. Several other sharpeners of this type, however, have a single cutter driven from a gear wheel and cutting from one side of the pencil only, the pencil being gradually turned as the work proceeds. In some of these machines the pencil is held in a simple friction clamp in which the operator turns the pencil about; in others, the pencil is automatically rotated. A recent machine of this type utilizes the milling cutter idea with a spiral cutter having 15 inches of cutting edge, designed to make a good point without strain on the lead. The pencil point is supported against a straight edge while this cutter is at work on it, and the last gives an extreme "draw cut."

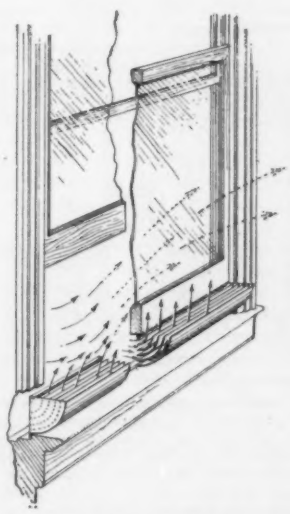
Another machine, an evolution from the schoolboy's toy which has been referred to, is designed to protect the wood-cutting blade from being dulled by work on the pencil lead. Turning the crank rotates the pencil itself rapidly against a stationary knife blade which takes off a thin spiral shaving from the wood of the pencil until enough of the lead to form a good point has been exposed, a separate abrasive tool then coming into play to grind the lead to a point.

Several forms of sharpeners which frankly imitate whittling have a disk carrying several sharp knife blades arranged radially which rapidly sliver the wood of the vertically held pencil as the disk is rotated. Slowly turning the pencil about and at the same time feeding it downward in its clamp closely simulates the action of a penknife in skilled hands. One representative of this type has the knives arranged to draw out the pencil point. Another handy little desk device, weighing less than three quarters of a pound, sharpens pencils by a reciprocating motion of a single adjustable blade carried on a rocking arm. The pencil is laid against a support in a slanting position and the blade is brought into action by a downward push instead of by the turning of a crank, so that the device does not need to be fastened to any support, but may serve also as a paper weight. The base is cup-shaped to catch the pencil cuttings, and stands on three rubber-tipped feet. This same chisel motion of a blade is utilized in another compact sharpener equipped with a vertical plunger like a dating or numbering stamp. The blade has 4 inches of cutting edge and it is kept in condition automatically by a sharpening stone, which is held against the blade by spring pressure. In this connection mention should be made of the little pencil sharpeners which may be found in some stationery stores—an attractive miniature jack plane for the desk or pocket.

An Efficient Air Deflector

An apparatus for changing the direction of a current of air with the minimum loss in the velocity of the same has been recently designed and patented by H. L. Van Zile of New York city.

The principle involved is shown in the accompanying illustration.



An efficient air deflector.

In this deflector a series of curved vanes are placed at equal distances from each other, presenting their edges to the current, and dividing the same into independent strata. Each independent portion impinges against a vane, and after being slightly deflected proceeds to the end of the protected passage without further loss of energy due to any impingement of the balance of the current. The energy actually lost, neglecting skin-friction, is due to the impingement of the strata against the lower portions of the vanes.

An application of the above principle is made for windows. With this device the wind is deflected to a vertical current inside of the room with a loss of only 13.3 per cent of its velocity. The energy of this vertical current is sufficient to deflect a horizontal current entering the window over the deflector, the amount of such deflection and the resulting direction being dependent on the relative strength of the two currents. It is, therefore, possible to have the lower sash raised above the deflector and still have the incoming air traveling to the upper portion of the room without disturbing papers on desks or tables. This feature, unique for this deflector, is very important during the summer months. During winter the sash can be adjusted to admit only the amount of air desired, and as this air will travel vertically at 87.7 per cent of the velocity of the outside wind, it will mix with the heated air at the top of the room instead of producing cold currents at the lower levels.

Recent investigations by well-known scientists show that the movement of air in a closed room is almost as important as the entrance of fresh air. This deflector accomplishes both results with the minimum amount of cold air owing to the high velocity of entrance.

A New Idea in Ink Erasers

INK erasers need improvement. Knives cut and scrapers roughen the surface of paper; rubber mixed with powdered glass or sand wears through and is apt to tear the paper, while chemicals discolor the paper and obliterate ruled lines, as well as the letters or figures they are applied to. A Syracuse inventor, Mr. J. K. Rush, proceeds on a different principle and with success.

The eraser he perfected consists of a brush made of especially prepared mineral fibers and containing no less than 4,000 strands each. As the brush is only one eighth of an inch thick and three eighths of an inch wide, it will be understood that each of the 4,000 strands of fiber is exceedingly tenuous; but they give to each brush just 4,000 microscopic, diamond-like points of peculiar sharpness, and together they form an erasing edge that is flexible, durable and extremely efficient. The brushes are not made of asbestos or mineral wool, but of a substance more like spun glass.

Each brush is two inches long and is contained in a tube of aluminium and German silver that is three and three quarters inches long and three eighths of an inch in diameter; turning a German silver cap on the end of the tube moves the brush in or out, as required.

Especially well adapted is the new eraser for removing single written or typed letters and figures from a line or column neatly and without affecting the adjoining marks; and it leaves the place of the letter or figure fit for use again without danger of blurring or blotting.

The Death of William Deering

IN the death of William Deering, one of the founders of the International Harvester Company, and himself long the head of the Deering Harvester Company, the American machinery industry loses one of its most conspicuous figures.

Originally a dry goods manufacturer and merchant, Mr. Deering eventually migrated to Chicago, where in 1870 he met E. H. Gammon, who had bought the rights to manufacture a harvester. Three years later Mr. Deering became the active head of the enterprise. Gammon told Deering that a machine was needed which would bind sheaves of wheat as they were cut. Deering began work upon this, and with J. S. Appleby invented the binder that is still in use. He is said to have left a fortune of $30,000,000, most of which was made out of agricultural inventions.

Deering is one of the men to whom America should be grateful for his achievements. It was his self-binder that made it really possible to harvest wheat without the aid of much manual labor and that places the name of Deering beside that of McCormick. How much the Deering binder has contributed to our agricultural prosperity no one can even guess.

A Worm That Operates Car Coupling Knuckle or Hook.—Joseph Kovacs of Kulpment, Pa., in patent No. 1,073,352 provides a segmental coupling member movable in an arc in the draw-head and on its outer side a worm gear meshed by an operating worm journaled in draw-head.

Notes for Inventors

Dr. B. W. Pond Resigns After Forty Years as Examiner.—Because of ill health, Dr. B. W. Pond has resigned after forty years' service in the examining corps of the Patent Office. President Wilson sent a letter to Dr. Pond thanking him for his many years of service, and complimenting him on the record he has made while in office. Dr. Pond was in charge of a very important division of the office, in which he looked after all inventions affecting civil engineering, bridge building, hydraulic engineering, and excavation. He is a native of Maine, and was graduated from Bowdoin College. He entered the Patent Office as third assistant examiner in 1873, and four years later was made primary examiner, which position he has filled for thirty-six years.

An Elihu Thomson Patent.—Patent No. 1,072,530 has been issued to the General Electric Company as assignee of Elihu Thomson for an electric heater in which a heat storage mass having good conductivity constitutes a wall of a heating chamber, while heat insulating means constitute the remaining walls of the said chamber and means are provided for producing an electric arc within the chamber for heating the storage mass.

Nine Car Truck Patents.—Herbert H. Hewitt of Buffalo, N. Y., has secured nine patents, Nos. 1,072,719 to 1,072,727 inclusive, for improvements in car trucks including improvements in the car axle journal boxes as well as in the car trucks proper.

An Advertising Ventilator.—Robert E. Carswell of Minneapolis, Minn., provides in patent 1,072,821 a combined ventilator and advertising device in which there is produced upon a suitable surface a representation of an automobile with the wheels having passages alined with them and the wheels rotatable and having, in their spoke zones, propelling blades so that the wheels will be rotated by a draft of air moving through the air passages alined with the wheels.

A Number of Dental Patents.—Frank H. Skinner of Chicago, Ill., has secured patents Nos. 1,072,517 to 1,072,521 inclusive for various forms of crown pin extractors including jaws for gripping the pin and means co-operating with the jaws for pulling the pin.

A Shiftable Individual Telephone Mouth Piece.—In patent No. 1,072,537 Clarence S. Warren of Milford, Ohio, shows a telephone mouth piece which has a band to fit around a telephone transmitter and a number of individual telephone mouth pieces carried on arms pivoted to the band so that each individual mouth piece may be applied to and removed from the telephone mouth piece as desired.

A New Patent Office Mail Order.—The new Commissioner of Patents, under date of September 5th, 1913, has given notice to those transacting business with the Patent Office that all mail matter arriving at the Washington post office up to the hour of closing business at the Patent Office each day will be entered as received on that day. In carrying out this, suitable arrangements have been made by the local post office.

Another Reinforced Cement Tie.—In patent No. 1,071,291 Louis Blessing of Jackson, Mich., shows a railroad tie of cement in which is embedded a longitudinal tension rod, bent to have lower portions directly beneath the rails and its intermediate portion bent upwardly to form a truss midway between the ends of the tie.

Milk Drying Process.—A patent No. 1,071,692 to Powdered Milk Company of America of New York city, assignee of Charles H. Brigham of Brooklyn, N. Y., presents a process which converts the liquid into a spray and causes a large amount of drying agent in the form of an envelope of forcibly projected air introduced under pressure moving in the same direction as the spray and traveling around it in such a manner as to present at each point on the path of the spray successive quantities of the drying agent.

RECENTLY PATENTED INVENTIONS

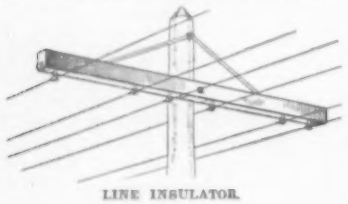
These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

REMOVABLE SANITARY HAT LINING.—ELLA V. HOUGHTON, 1314 Spruce St., Philadelphia, Pa. This invention provides a readily detachable lining pack; provides a single-service lining pack removable from the hat by each prospective customer, prior to, or subsequent to, trying on a hat; prevents possible transference of vermin incident to trying on of hats in stores; and provides for mounting a number of linings and for applying and adapting said mounting and attached linings to hats of various shapes and sizes.

Electrical Devices.

LINE INSULATOR.—O. C. MEUSEBACH, 1306 Avenue B, San Antonio, Tex. The more particular purpose of the inventor is to provide an insulator suitable for use upon telephone



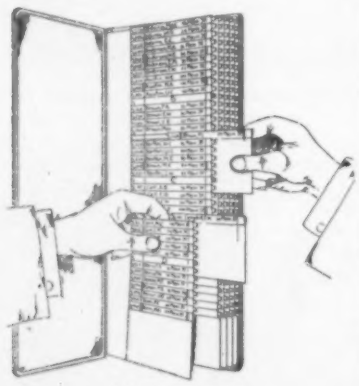
LINE INSULATOR.

and telegraph lines, as well as upon lines for general service of various kinds, a special object being to improve the insulation of the line and at the same time to render the construction comparatively clean, simple, and in many ways efficient.

Of General Interest.

DISPLAY CASE.—H. N. LINES, Sabetha, Kan. It is an object in this invention to provide a case in which the opening of the cover will automatically lift the tray to a position to effectively display the goods, and in which the closing of the cover will automatically lower the tray and inclose the same.

ACCOUNT INDEX.—W. E. ROACH, care of San Antonio Lodge, 216, B. P. O. E., Elks Bldg., 217 Avenue E, San Antonio, Tex. The object of this invention is to provide such an arrangement that cards may be held in a series in which a portion of each card is visible, these cards being reversible and each having upon



ACCOUNT INDEX.

its opposite face a symbol which when turned to view will serve to call attention to the particular card. The cards and their supports may be reversed. Thus, the cards on which the accounts are due may be turned so as to expose the indicating symbol, and thus permit of the account due cards being readily and quickly distinguished from the remaining cards.

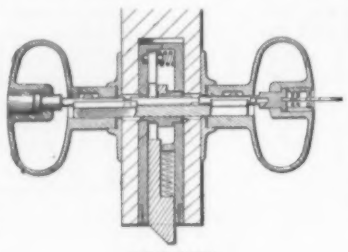
Hardware and Tools.

ACTUATING DEVICE FOR WINDOW SASHES, SHUTTERS, AND LIKE MOVABLE PARTS.—W. H. SYMONDS, Saranac Lake, N. Y. In the present invention the object is to provide a new and improved actuating device, more especially designed for conveniently opening and closing sashes of casement windows, shutters and the like, from the inside of a room and to securely lock the part in either open or closed position.

RAZOR AND GUARD THEREFOR.—A. OBERHEIM, Box 610, Ogden, Utah. This improvement relates to razors of the safety type and guards therefor and has for an object to provide an improved structure which may be easily assembled and disassembled, and will when assembled present a simple effective construction.

FRUIT AND FLOWER CUTTER.—C. F. BILLAU, Cedar Rapids, Iowa. This invention relates generally to a cutting device adapted to be held on the finger, and more particularly to one especially adapted for use in cutting fruit and flowers. The principal object is the provision of a device the body member of which is made of resilient material and in spiral form. Means provide for preventing the device from turning about the finger.

DOOR LOCK.—PLEASANT F. MANNING, Oklahoma, Okla. This invention provides a combined door latch and lock. An object of the improvement is to reduce the trouble and expense in fitting a lock in a door by providing



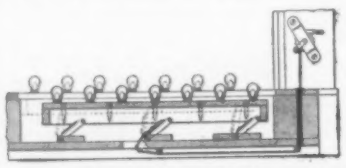
DOOR LOCK.

a lock which may be inserted in a cylindrical opening made by an ordinary brace and bit without the necessity of mortising the door. Further object is to reduce the number of parts and to lessen the cost of a good substantial lock.

Heating and Lighting.

ELECTRIC HEATER.—W. DUBILIER, 176 N. 4th St., Brooklyn, N. Y. The invention relates to electric heaters and the object is to provide an improved radiating element for this class of devices, as well as improved means for supporting the same to enable it to be conveniently used in any location where electric power can be obtained.

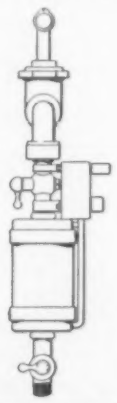
STAGE FOOTLIGHTING.—C. M. TAYLOR, Loyal, Wis. The invention refers more particularly to lamps mounted on a carrier which is slidably mounted in the structure of the stage floor, and means for adjusting the lamp



STAGE FOOTLIGHTING.

carrier with reference to the floor of the stage. It provides a structure for footlights whereby a variation in the quantity of light thrown by the same on the stage can be arranged; reduces the space occupied by the footlights; and makes it possible to utilize the entire floor space of the stage when the lights are not in use; that is, are in inoperative position.

ELECTRIC WATER HEATER.—J. POLAK, 1381 Madison St., Brooklyn, N. Y. This improved electric water heater is characterized by a number of concentrically arranged heating elements, the spaces between them forming



ELECTRIC WATER HEATER.

chambers through which water flows, the heating elements being surrounded on all sides by the water, means being provided whereby the volume and temperature of the liquid may be regulated or controlled.

Household Utilities.

APPARATUS FOR COOKING MEATS.—F. BRIGGS, Washington, D. C. The primary object of the present invention is to provide a cooking apparatus with means for accurately indicating the shrinkage of meat during the cooking, and to limit the action of the spring by which the meat is compressed or packed while cooking.

PUMP FOR VACUUM CLEANERS.—I. BARKER, Springfield, Ill. This invention includes an element securable to the body of the operator, and connections between the pumping devices and said element, the arrangement being such that both hands of the operator are free to manipulate the apparatus to cause it to produce a pumping action.

SHOWER BATH PAIL.—R. E. JONES, Fort McPherson, Atlanta, Ga. This invention pertains to improvement in portable shower baths, especially those designed to be used also as ordinary pails. Articles heretofore produced for this purpose have either been leaky when full of water or else complicated, heavy, and costly to manufacture. The object is to produce a light, durable article that will be satisfactory both in the capacity of a pail and a shower bath and, at the same time, will be easily and cheaply made.

Machines and Mechanical Devices.

WIND DEVICE FOR AUTOMATIC MUSICAL INSTRUMENTS.—E. J. LUSTER, 47 Fuller Place, Brooklyn, N. Y. In the present patent the invention has reference to improvements in rewinding devices for player pianos, and has for an object the provision of an improved structure which may be caused to operate at any time for rewinding the roll quickly.

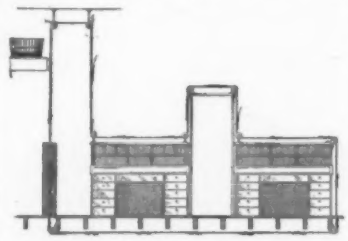
DITCHING MACHINE.—E. B. WILSON, Box 115, Worland, Wyo. This machine varies the distance of the place of earth deposit from the ditch by a certain endwise adjustment of the rear or cross draper, and provides a means for trimming the sides of a ditch to a smooth slope instead of vertically as with the common plow. Means are also provided for adjusting the plow, while in use, so as to regulate the depth of the cut, thus holding an even grade, and allow a swinging motion of the plow and plow beam about a horizontal axis.

WOOD GRINDING MACHINE.—H. S. CHALFANT, Grand Mere, Quebec, Canada. The invention provides a machine with removable teeth spaced apart and arranged in series to pass in juxtaposed relation, the clearance between the passing teeth being such as to produce a shearing action on the wood bits fed thereto; provides teeth removable to be readily replaced; provides for progressively increasing the speed of the grinding members; and provides grinding teeth, the surfaces whereof macerate the wood particles delivered therebetween.

PUMP WORKING BARREL.—J. F. KILBURN, care of G. E. Wallace, 416 Caples Bldg., El Paso, Tex. The purpose of this invention is to construct a pump cylinder of glass whereby the friction of the piston is reduced to a minimum and to so mount the cylinder with respect to the other portions of the pump as to make it thoroughly reliable in practical operations.

APPARATUS FOR REFINING LEAD.—J. F. BEATTIE, 457 E. State St., Hammond, Ind. In order to refine lead by removing gold, silver, arsenic, tellurium and other impurities this inventor makes use of two separate crystallizers and two separate kettles, the kettles having vertical movement to permit of running the resultant liquid in one crystallizer into a kettle to be transferred to the other crystallizer.

CONVEYER.—J. J. CURTIS, 1960 W. 5th St., Gravesend, Brooklyn, N. Y. The aim of this invention is to provide a conveyer construction comprising essentially an endless belt or equivalent device with a plurality of clamps thereon, together with suitable pulleys or equivalent elements around which the belt



CONVEYER.

passes, certain of the pulleys being so constructed that the printed sheets held in clamps are not displaced therefrom, there being another pulley for opening the clamp whereby the sheet carried thereby may be deposited in a suitable receptacle.

KINEMATOGRAPHIC APPARATUS FOR TAKING AND PROJECTING VIEWS BY MEANS OF PHOTOGRAPHIC PLATES.—RENÉ A. ROBIN, Paris, France. This invention has for its object an improvement in kinematographic apparatus wherein pictures are projected upon a screen in such rapid succession that the effect of movement is obtained, and wherein means is provided for projecting pictures on ordinary glass plates instead of films.

SUBMARINE CULTIVATOR AND HARVESTER.—N. A. LYBECK, Bristol, R. I. This inventor provides a machine which may be employed to cultivate and for submarine fishery beds, and more particularly oyster beds, and to harvest the yield thereof; constructs and arranges a machine which may be employed to gather, sort, distribute and store the said yield; and provides a supporting vessel and gathering mechanism so connected as to permit the roll of the vessel without changing the angle of operation of the gathering device.

WATER GAGE COCK.—D. DAVIES, 775 North Second West St., Salt Lake City, Utah. An object here is to provide a device having a movable valve member arranged to be brought into registration with an outlet passage to permit the outflow of water or steam with means permitting the removal of the valve while the boiler is still under steam pressure.

PORTABLE AUTOMATIC COUNTING DEVICE.—R. M. MCCULLOCH, care of Chas. H. Leonard, 161 Washington St., New York, N. Y. Among the objects of this invention, more definitely stated, with or without a truck or cart, or a beast of burden, moving along a certain line of operation, may operate upon certain mechanism for the purpose of registering the number of times a certain point or platform is traversed.

DEPULPATING MACHINE.—A. TERESA, 1528 Arch St., Philadelphia, Pa. This machine operates upon fibrous or textile plants, and has particular reference to means for depulpating fibrous leaves of tropical or semitropical plants, whereby the fleshy or meaty body portion of the leaves is removed from the fibrous portions as distinguished from decorticating machines which are employed for removing the bark, skin, hull or rind from objects.

DRILLING MACHINE ATTACHMENT.—J. E. POOL, Wetumka, Okla. An object of this improvement is to provide an attachment which may take the place of the foot-piece or bed plate now used on machine drills. A further object is to provide a device by means of which a round object such as a pipe or other similar device may be securely held.

FISH TAIL PROPELLER.—B. STEVENSON, 1322 Rock St., Little Rock, Ark. It is a design of this invention to provide operating means for giving an oscillating motion to the paddle. Also to provide a means for turning the paddle about its axis of oscillation, to locate the angle of oscillation in different positions for propulsion in different directions whereby the propeller may be used for steering, and for forward and backward propulsion.

Prime Movers and Their Accessories.

COMBINED MUFFLER AND OIL GAS PRODUCER.—A. O. HISCOCK, Palatka, Fla. This invention relates to combined mufflers and oil gas producers, particularly adapted for connection within the exhaust pipe of an internal combustion engine, the object being to provide a construction whereby the functions generally presented in such a device may be readily and effectively accomplished.

ROTARY ENGINE.—T. W. MOORE, deceased; T. V. MOORE, administrator, Miami, Fla. This invention has reference to a new and improved engine of the rotary type, in which the force is supplied directly to the shaft. An object is to provide a device which will be simple in construction, inexpensive to manufacture, strong and durable, and both positive and efficient in its operation.

Pertaining to Vehicles.

WHIFFLETREE HOOK.—O. B. HAGA, 3039 W. Manning, Seattle, Wash. The object here is to provide a hook having mechanism for preventing the accidental disengagement of the trace or tug so long as there is any draft exerted on the hook or when the draft is relaxed, but which may be easily disengaged to release the trace or tug when there is no draft exerted on the hook.

METALLIC WHEEL.—S. H. SUMMERSCALES, Winnipeg, Manitoba, Canada. This invention relates more particularly to a rim construction especially for use with wheels such as described and claimed in a pending application of Mr. Summerscales, No. 637,492. The principal object is to provide a means of securing the sections of a metal rim together, whereby such rim will withstand rough usage and will sufficiently perform its duties.

COMBINED SPRING AND FRICTION SHOCK ABSORBER.—C. N. SOWDEN, Guantanamo, Cuba. The present invention relates to shock absorbers, in which the resistance of the vibrations will be proportionate to the shocks, and in which plural degree friction units are brought successively into action by the relative movement of the levers or securing arms that connect the shock absorber to the chassis or body, and to the running gear, respectively.

BOTTLE HOLDER.—C. N. SOWDEN, Guantanamo, Cuba. This invention provides a bottle holder for use on automobiles and other vehicles, which may be employed to properly hold and sustain the bottle in position, and which will at the same time permit the ready removal of the bottle when desired.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Inquiry No. 9340. Wanted the name and address of manufacturers of knock-down barrels, staves, hoops and heads which may readily be assembled.

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Inquiry No. 9342. Wanted, a machine to cut No. 18 wire in 2½ inch lengths and sharpen both ends similar to tack points. One operation preferred.

Inquiry No. 9343. Wanted the name and address of manufacturers of machines for grinding the peel of oranges and grapefruit.

Inquiry No. 9344. Wanted name and address of manufacturers of patent articles of merit suitable for mail order distribution.

Inquiry No. 9345. Wanted name and address of manufacturers of Oxy-Acetylene Cutting and Welding Torch, also an easy opening can suitable for shoe polish.

Inquiry No. 9346. Wanted the name and address of parties manufacturing tobacco stripping machines, and other machines pertaining to cigar manufacturing and cigar banding machines.

Inquiry No. 9347. Wanted the name and address of an industrial school where shoemaking is taught in all its branches.

Inquiry No. 9348. Wanted the name and address of manufacturers having useful household necessities, with a view to obtaining exclusive territory for a house to house canvass.

Inquiry No. 9349. Wanted the names and addresses of the makers of machinery for making Malt Tonic, also a machine for making grease, and machines for applying plaster (Cement Gun).

Inquiry No. 9350. Wanted the name and address of the manufacturer of a printing press for the printing of tapes for clothing. The machine should preferably be worked by hand.

Inquiry No. 9351. Wanted to make some article out of wood which could be made from 2 inch ash, by party having 75,000 or more feet of waste per year which is now used for fuel.

Inquiry No. 9352. Wanted the name and address of a person who is in a position to get the state or county agency for articles of merit that can be sold to business houses or others at $3.00 or over. No kitchen utensils desired.

Inquiry No. 9353. Wanted the name and address of a manufacturer who can make flexible oil cans.

The Blessings of Science on the Battlefield.

(*Concluded from page 477.*)

him until human assistance comes. The performance of the *chien sanitaire* is more elaborate and, characteristically, somewhat more spectacular; he obtains possession of the patient's hat, or belt, or anything that can be rummaged out of his pockets, and, carrying this as evidence, first reports to the surgeon and then leads the way back to the sufferer.

Military surgery has now made an elaborate classification of wounds with respect to their danger and difficulty of treatment. For a general idea, however, the accompanying diagram is sufficient, dividing the wounds according to their location in the human body, into slight, serious and very serious. This diagram is reproduced from Forgues' "Traité de Pathologie Externe." A statistical calculation made by one of the leading surgical authorities of the French gives the relative frequency of wounds not instantaneously mortal as: slight, 60 per cent; serious, 15 per cent; very serious, 25 per cent. On the whole, the experience of recent wars shows the head and the right arm as the most frequent lodging places of projectiles.

The greatest difficulty of modern military surgery seems to be in abdominal wounds. Their healing depends on the early application of treatment and on the feasibility of keeping the patient quiet for a long period. Wounds of this type wrought great havoc in the battle of Spion Kop, where the wounded had to be conveyed down a rocky cliff before undergoing operation. On the other hand, a large number of Russian soldiers suffering from abdominal wounds at Mukden were successfully treated, with laparotomy, by the skill and admirably organized resources of the Surgeon-Princess Gedroitz.

Atlantic Steamships.

(*Concluded from page 473.*)

the increase in the motive power, coupled with this reduction in passenger-carrying capacity, would render the ship an altogether unprofitable venture for the company.

As regards the possibilities of the future, it is certain that any of the leading shipbuilding firms would undertake to build a large transatlantic steamer with a guaranteed speed of 30 knots. But to guarantee that she would be profitable is altogether another question; for it is well understood among shipping men, that, were it not for the very liberal assistance rendered by the British government, in the loan of the capital for construction at the low rate of 2½ per cent, and in the payment of an annual subsidy for the "Mauretania" and "Lusitania" of $750,000, these two fine ships could not be run at a profit.

Nevertheless, we are of the opinion that it would be possible, even without government assistance, and by a considerable increase in the passenger rates, to build a 30-knot ship which would yield a fair revenue to its owners. The hope for this, at least so far as the operating expenses are concerned, lies in the great promise afforded by the new helical reduction gear. Judging from what the battle-cruisers have done with a straight turbine drive, it is worth consideration whether the reduction in the weight of engines and boiler plant, due to the use of reduction gear, and the great saving in the coal bill due to the higher economy of fast-running turbines combined with slow-running propellers, would not make it possible to set afloat a 30-knot liner, carrying first cabin passengers only, and whether such a ship in these days of multiplied wealth, would not attract sufficient first-class passengers at high rates to make the voyages profitable.

Cement Blocks Made by Centrifugal Machine.—Nathaniel P. Annis of Chicago, Ill., in patent No. 1,073,584 describes a centrifugal block machine in which a mold is hinged at its upper edge to the rotatable drum so that it can be elevated to facilitate the removal of the molded block.

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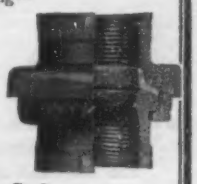

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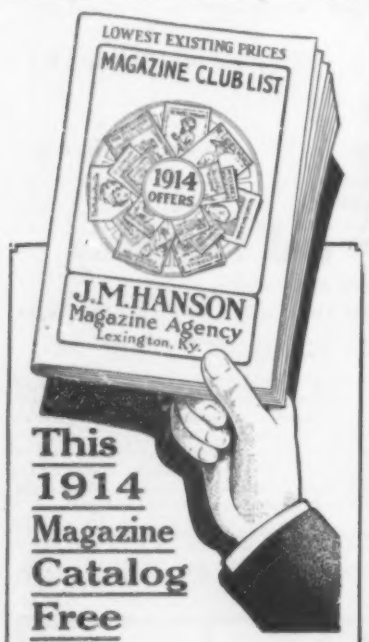

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Inspecting Track Scales

(Concluded from page 468.)

pressed on scale manufacturers, freight agents and other railroad officials, and shippers and owners of scales on sidings. Further trips of inspection and investigation throughout the United States are soon to be undertaken and the Bureau of Standards hopes to gain information that will lead to the formulation of proper national standards that will be available in any event and more especially should the Government by statute or through its Interstate Commerce Commission seek to control and regulate railway weighings. At the same time the work of inspection, which will extend throughout the United States, judging from the results already achieved in New England, will result in greater accuracy and efficiency in building and operating railway track scales, an important subject in which many railroads and shippers are now definitely interested.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12877) F. G. B. asks: 1. I understand that two lead balls colliding "head on" would not rebound. But suppose they collided with only say 1.10 of their diameters overlapping. Surely they would not come to a dead stop. What would their subsequent paths be? A. The direct and central impact of two inelastic bodies of equal weight will destroy the momentum of both, and the resulting velocity of both will be zero. Both will be brought to rest. If their impact is eccentric, a couple will result. The balls will rotate around each other for a part of one turn, and each will then move off in a straight line tangent to the circular arc in which they moved around each other. This will be determined by their relative directions before impact. 2. I understand there are "inert gases." How do their molecules behave after collision? A. There are "inert gases," but the term refers to their chemical nature and not to their motions after collision. All gases are elastic. Perfect elasticity of molecules is assumed. Nitrogen is an inert gas. Argon is still more inert. Neither will enter into combination with other elements under ordinary circumstances. To bring nitrogen into combination with oxygen directly, a very high temperature is required. The electric furnace is usually employed to cause them to combine and form oxides of nitrogen. 3. You recommend Young's "Manual of Astronomy." What year was it published? A. Young's "Manual of Astronomy" was first published in 1902. It was reissued in 1909, with the necessary changes and additions. It is widely used as a college textbook. A simpler descriptive astronomy published this year, 1913, is by George F. Chambers, which we will send for $1.50 by mail. We recommend both books very highly.

(12878) W. N. G. asks: When sodium chloride (NaCl) goes into solution, what is the action that occurs? Does the sodium interact with the water to form sodium hydrate and hydrogen, and the chlorine combine with the water to form hydrochloric acid and oxygen, which in turn unite to form sodium chloride and more water, or do the sodium and chlorine ions remain separate and inactive? A. The ionization of sodium chloride requires that sodium ions charged positively and chlorine ions charged negatively shall be formed when sodium chloride is dissolved in water. These ions are not metallic sodium and gaseous chlorine. If they were the chain of chemical reactions which you describe might take place. They are simply different substances from those named above. Each carries a charge of electricity. They do combine with each other, and to the same amount other molecules of the sodium chloride dissociate again. The action is always taking place in the solution. The subject is well treated in Alex. Smith's "Inorganic Chemistry," chapter on Electrolysis. We send the book for $2.45 postpaid.

(12879) W. C. E. asks: Supposing a heavenly body was located so far away from this earth that it required light 1900 years to travel the distance. And supposing an intelligent being were located upon this remote body with a telescope powerful enough to see small objects here. If he were to look now at our earth through his telescope, would he see life on this planet as it appeared in Christ's time or would he see it as it existed at the instant he looked? A. We see an object by simply turning our eyes in its direction from us, in order that the light which the object is sending out in every direction may enter the eye. Then we say we see. The light from near objects comes so quickly that we see instantaneously. Light from remote objects takes an appreciable time for its passage, and brings to our eye that which was occuring when it started upon its flight. It cannot report later

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By ALFRED P. MORGAN. 12 mo., 154 pages, 156 illustrations. Price, $1.00.

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events at its starting point. A person who should look at the sun would receive the light into his eyes which started 8 minutes 19 seconds before he looked. Whatever it shows him took place that length of time before he sees it. The same is true of the light of the most distant heavenly body. The astronomer at his telescope discovers a new star, but the outburst of light from that star occurred centuries ago. The astronomer sees an occurrence centuries old. In the case which you propose, the observer would see what occurred at the time of Christ's birth. Light requires time to traverse the celestial spaces. Indeed, the time required to traverse a distance of a few miles on the earth has been measured. Prof. Michelson and Prof. Newcomb measured the time required for light to go from the Washington Monument in Washington to Fort Meyer and back and on this based their calculations that light moves 186,300 miles a second. See SUPPLEMENT 557, price ten cents.

(12880) L. G. B. asks: Is it not true that the direction of rotation of the magnetic field around a current-bearing wire always bears the same relation to the direction of the current? To me that is a mystery, just as the uniform direction of rotation of a cyclone in the Northern Hemisphere must have been to the Indians who didn't understand the effect of the rotation of the earth on the atmosphere. Probably the Indians never gave it a thought. Similarly, so far as I can find, nobody has given this a thought. Why doesn't the magnetic field rotate indifferently—sometime clockwise, and sometimes anticlockwise? A. The lines of magnetic force always produce the same effect upon a suspended magnet, and turn it always in the same direction. The reasonableness of this result to the mind of the scientist is probably due to the fact that he believes that like causes always produce like effects. That a north pole should sometimes turn to the right and sometimes to the left of the direction of the current would be unthinkable under the laws of nature, as much so as to have the sun sometimes rise in the east and sometimes in the west. 2. I understand that a wire carrying a current of electricity is surrounded by a rotating magnetic field; or at least that the field would cause a very light and flexible metallic ribbon to wind around the wire, and *always in the same direction relatively to the direction of the current.* I frequently see this mentioned, but never as a mystery calling for an explanation. *Why does the magnetic field always have the same direction of rotation, relatively to the direction of the current?* A. A magnetic field surrounding a wire carrying a current would cause a single magnet pole to move around it in a specified direction. It would not cause a metallic ribbon to wind itself around the wire unless that ribbon were a flexible magnet or a wire carrying a current of electricity. The fact is one thing, the theory as to the cause of the fact is quite another. The theory has to do with lines of force and their relation to each other. The explanation of many of these phenomena may be found very plainly put in Sloane's "Practical Electricity," which we send for $2.50 postpaid.

(12881) W. M. G. asks: 1. We are living in longitude 103 deg. W. and latitude 37 deg. N. Here in the summer months the sun rises in the morning about 20 deg. north of east and sets likewise 20 deg. north of west, but at noon it casts its shadow on the north side of a house. Will you kindly explain this? A. In latitude 37 deg. the sun at the summer solstice, which is June 21st in the northern hemisphere, is 13 deg. 30 min. south of the zenith, and so casts a short shadow to the north side of a house at noon. To see the sun cast no shadow on that day one must go to the Tropic of Cancer, at which latitude the sun will be in the zenith and shine vertically down on one's head. A vertical pole will cast no shadow. On June 21st the sun is 66 deg. 30 min. from the north pole of the heavens and will rise about 20 deg. north of the east and set at the same distance north of the west point of the horizon, but it also culminates 66 deg. 30 min. south of the pole, or in your latitude 13 deg. 30 min. south of your zenith. Hence shadows fall to the north at noon, shadows fall to the south in the northern hemisphere in the morning until the sun reaches the east, or crosses the prime vertical. 2. How much allowance do surveyors make for the curvature of the earth's surface for the distances 100 yards, 600 yards, 1,200 yards, and 1,760 yards (one mile)? A. The curvature of the earth is 8 inches for one mile. Since the curvature varies as the square of the distance, for a half mile it is one fourth of 8 inches, or 2 inches. For 100 yards the curvature is found by a proportion, as follows: $1{,}760^2 : 100^2 = 8$: answer. There are 1,760 yards in a mile. Having found the curvature for 100 yards, the curvature for 600 yards will be 36 times as much, and for 1,200 yards it will be 144 times as much as for 100 yards. 3. Will you please give me the formula whereby the opposite legs of a right-angle triangle may be obtained when the hypotenuse and the angles are known? A. The formula for finding the sides of a right triangle when the hypoteneuse and angles are known is, multiply the hypotheneus by the sine of the opposite angle. 4. Have you a book on ditch surveying and plating of ditches, etc.? A. The surveying of inundated lands is taken up in Elliott's "Engineering for Land Drainage," which we can supply for $2, postpaid.

(12882) A. G. B. asks: I would like some information as to the construction of a simple wireless station, as I am going to build one. I will be very thankful for all the information you can give me on the subject. A. We would recommend to you the book, Morgan's "Wireless Telegraph Construction for Amateurs," which we send for $1.50. This book describes all the apparatus and the mode of putting it up. It also gives the laws for the licensing of amateurs by the Government and other information which one should have in entering upon such work.

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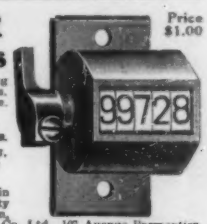

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THE AMERICAN FERTILIZER HAND BOOK. Philadelphia: Ware Brothers Company, 1913. 4to.; 351 pp.; illustrated. Price, $1.

This is largely a directory of the fertilizer industry and allied trades, and presents the manufacturers of the United States, keyed to indicate the exact nature of their business, and arranged by States; the cottonseed oil mills, in similar arrangement; allied trades classified, manufacturers of machinery and factory equipment, brokers, importers and exporters, and chemists; and to these lists are added special articles and statistics that will prove of great interest to the trade.

FATIGUE AND EFFICIENCY. By Josephine Goldmark, Publication Secretary National Consumers' League. New York: Charities Publication Committee, 1913. 8v.; 358 pp.; Price, $2.

A remarkable book in every way is this of Miss Goldmark's. It has a distinct advantage over such studies as those of Prof. Munsterberg, because it deals with actual and not with laboratory conditions. To readers of technical journals, Miss Goldmark's investigation of the effects of scientific management upon workers will probably be most interesting. Her criticisms, it must be admitted are decidedly fair. She realizes how much can be accomplished when the new science of efficiency engineering is applied in the hands of humane engineers of the Emerson, Taylor and Gilbreth type, men who realize that a human being must be treated at least as well as the machine of which he has charge. While Miss Goldmark would not abolish scientific management, she realizes the dangers that lie in "speeding up" when selfish interests alone are allowed to dominate. She would apply the functional foremanship of Mr. Taylor and the line and staff system of Mr Emerson to the conserving of laborers as well as machines, or as she puts it: "What first-class authority, nay, what specialist at all, is called in as consultant for the lives of mortal men and women singularly responsive and singularly influenced by the new and unstudied forces released by the new system of production?"

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THE EARTH. Its Genesis and Evolution. Considered in the Light of the Most Recent Scientific Research. By A. T. Swaine. Philadelphia: J. B. Lippincott Company, 1913. 8vo. 277 pp.; with plates and other illustrations. Price, $2.50 net.

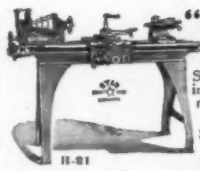
Careful summarizing and thoughtful reasoning are here couched in everyday language that makes its appeal to the general reader as well as to the geologist and the metaphysician. The trend of the argument is toward the acceptance of matter as materialized force. Recognizing that the second step in the nebular hypothesis is not consistent with proven laws, the author endeavors to build up a theory that shall utilize only known principles, based upon the facts of astronomical research. Arguing from fundamental processes of nature, he places the sequence of changes as gaseous, aqueous, lithoeus, igneous, corroborating this sequence by the spetrum analysis of the original nebulæ. Before the gas may be placed the universal ether, this presumably being the original basis of all things, change of potentiality in this medium giving rise to all material phenomena. Geology of course furnishes the backbone of the discussion. The origin of sedimentary rocks is treated as analogous with modern ocean deposits, and much space is devoted to ocean transgressions and the part played by them in the formation of the earth's crust.

UNITED STATES OFFICIAL POSTAL GUIDE. July, 1912. Albany, N. Y.: J. B. Lyon Company. Paper-covered annual number, $3. Cloth-covered annual number, $3.50. Including monthly supplements.

This is the official publication which is supplied to all postmasters, for consultation as to methods of procedure in routine duties and in certain exigencies. It includes an alphabetical list of all post offices and branch post offices, as well as a list by States. Discontinued offices are tabulated separately. The publication offers official and useful information to many beside postmasters. Business houses and shipping departments will be greatly benefited by keeping a current copy for ready reference.

NEW YORK CHARITIES DIRECTORY. An Authoritative Classified and Descriptive Reference Book to the Social, Civic and Religious Resources of Greater New York and Vicinity including National Organizations whose Aims and Activities Bring Them Within its Scope. Compiled by Lina D. Miller. New York: Charity Organization Society, 1913.

The Directory offers annually a fund of readily-accessible information regarding the numerous agencies for charitable work that find their sphere of usefulness in and about New York. Their organization, aims, and methods are briefly outlined. In addition to the general index is a name index, whereby the connection of any person with any charity may be expeditiously ascertained.



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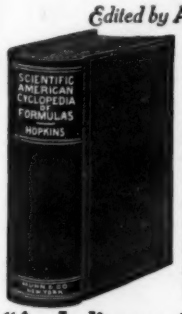

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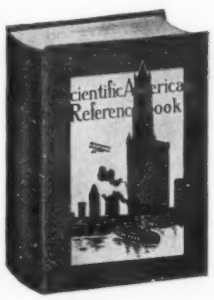

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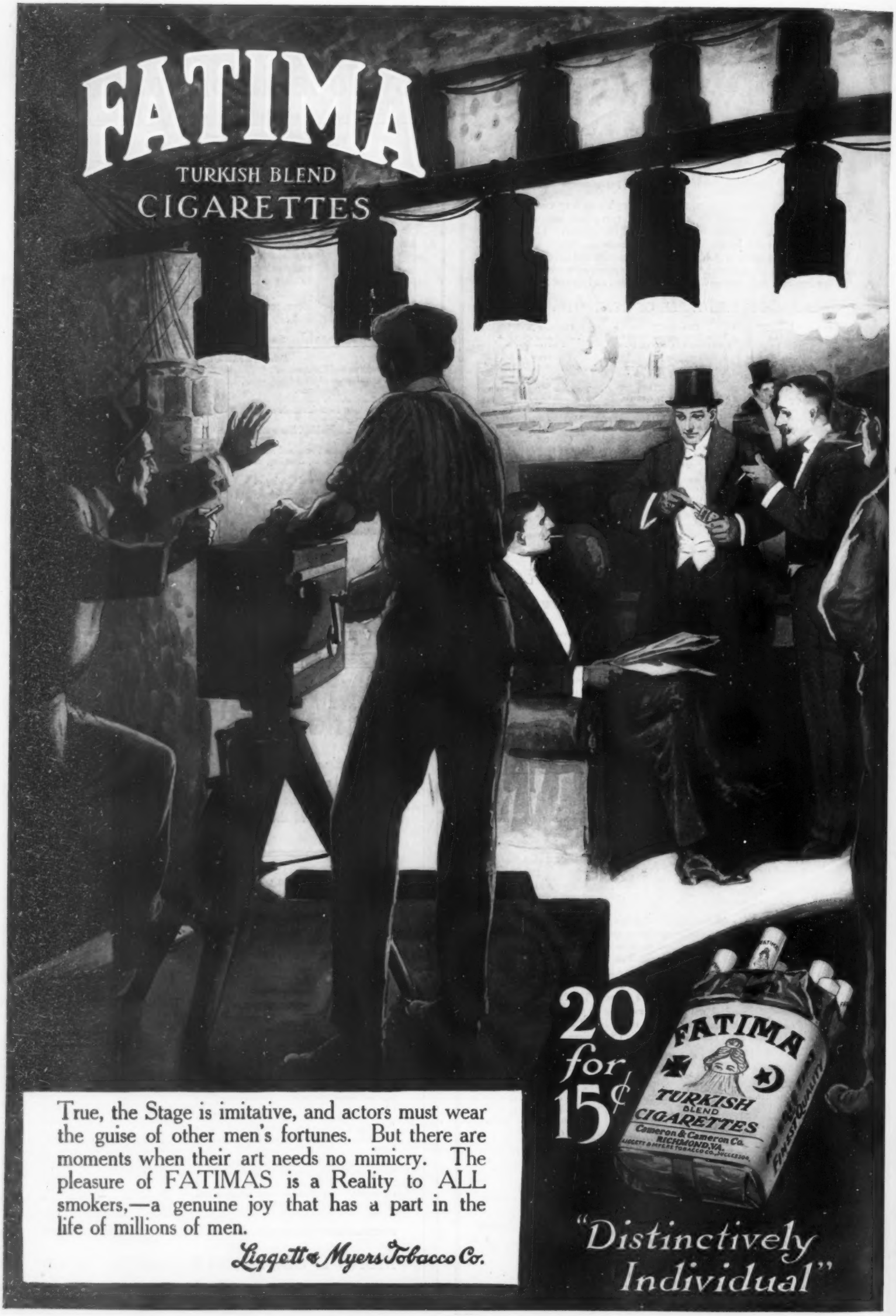

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